MANAGEMENT AND THE OCEANOGRAPHY COMMUNITY: A CONSIDERATION IN FUTURE NAVY OCEANOGRAPHY PLANNING

Samuel Wilson Sigmund

NAVAL POSTGRADUATE SCHOOL
Monterey, California

Department of Oceanography 2 October 1972

This thesis is one of a series of studies prepared at the Naval Postgraduate School concerning education and training in oceanography. The series includes:

1. "Oceanographic Education of the Naval Officer," by Rear Admiral Robert W. McNitt published in Proceedings of the 6th U. S. Navy Symposium on Military Oceanography, Applied Physics Laboratory, University of Washington, Seattle, Washington, May 1969.

2. "Officer Education and Training in Oceanography for ASW and other Naval Applications," by LCDR Larry W. Waterman, USN, M. S. thesis, March 1972.

3. "Management and the Oceanography Community: A Consideration in Future Navy Oceanography Planning," by LCDR Samuel W. Sigmund, USN, M. S. thesis, September 1972.

4. "A Study of Enlisted Training and Education in Applied Oceanography," by LCDR Karl L. Schriner, USN, M. S. thesis, September 1972.

The first study suggested that billets for oceanography subspecialists be P-coded aboard certain fleet units such as destroyer type ships, submarines, and ASW squadrons and the staffs which support them, and that the billets be established in such a way that postgraduate education was highly desirable but not essential in filling them.

LCDR Waterman's thesis recommended sub-specializations within oceanography and emphasized the relationships between the recommended programs and specific billets throughout the Navy. It featured the ASW application and ocean technology.

LCDR Sigmund's study showed the need for some formalized management education for oceanographers and recommended specifically how it might be arranged.

Finally, LCDR Schriner's analysis concerned all oceanographic education and training for enlisted men. It discussed the working relationship in oceanography between enlisted men and commissioned officers. Based upon the results of a questionnaire it recommends changes in the present program of oceanography training including the establishment of a career pattern for "specialists."

Dale F. Leipper

DALE F. LEIPPER
Chairman

NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

Management and the Oceanography Community: A Consideration in Future Navy Oceanography Planning

by

Samuel Wilson Sigmund

Thesis Advisor: J. A. Galt

September 1972

Approved for public release; distribution unlimited.

Management and the Oceanography Community:

A Consideration in Future Navy Oceanography Planning

by

Samuel Wilson Sigmund
Lieutenant Commander, United States Navy
B.S., United States Naval Academy, 1959

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OCEANOGRAPHY

from the

NAVAL POSTGRADUATE SCHOOL
September 1972

ABSTRACT

This study examines the need for oceanography specialists and subspecialists to possess a degree of managerial expertise and concludes that some type of formalized management education is required. Special management skills are required for optimum performance by oceanography officers in nearly all of the more senior billets - Captain, Commander, and the majority of the Lieutenant Commander billets. The study presents the reasoning which leads to the above conclusion and then answers four basic questions: (1) Which oceanography billets require a higher degree of special management skills? (2) Which particular management skills are required? (3) What facilities and/or methods are available for acquiring these skills? and (4) At what level, or rank, would it be most beneficial to acquire these skills?

TABLE OF CONTENTS

I. INTRODUCTION

The word "management" can be interpreted in a variety of ways and its use often calls forth very definite, preconceived ideas. In this study, the word "management" or, more specifically, the term "management education" is intended to mean that education which will improve an officer's capabilities for planning, organizing, directing, coordinating and controlling activities in which the resources of men, money, and materials are combined to accomplish Navy objectives.

The naval officer is gradually prepared through experience in his early commissioned years to deal with the typical military organization problems. At a certain phase of his career, he will find himself thrust, usually somewhat suddenly, into an organizational environment that requires him to operate, essentially, as a manager or administrator. This is an environment which may not be strictly Navy in nature, which will require close working relationships with other military services and civilian counterparts, and which will require a significant readjustment period on the part of the officer. Because of the nature of probable assignments for the officer with advanced technical education, this readjustment period is more likely to come at an early career point and to be quite difficult. It is believed that the readjustment period can be reduced in length, the difficulties reduced in severity, and the effectiveness of th

officer increased substantially by proper preparation in management and administration tools and techniques.

In May 1971 during the 8th U. S. Navy Symposium on Military Oceanography, Captain E. M. Cummings, Jr., the Assistant Chief of Staff for Administration and Training in the Headquarters of the Oceanographer of the Navy, spoke on the subject of, "Navy Needs for Officers Educated in Oceanography." [1] In the course of his presentation, Captain Cummings referred to the "managerial potential" of oceanography educated officers and listed specific areas in which this potential could be realized. These areas included: planning; liaison between the scientific community and operating forces in operational, staff or laboratory billets; instructor duties; independent research in oceanography; and management of environmental programs. When questioned as to how this management potential was developed, Capt. Cummings replied that an officer, in the normal course of his early career aboard a ship, acquires a degree of management experience through his gradually increasing responsibilities for men and equipment.

This same opinion, as to the gradually developing management background and experience, has been widely held in the past throughout the Navy and still prevails to a large degree in certain sectors of the Navy, most notably in the operating forces. There has been during the past several years, however,

a growing awareness that our Navy's complexity, in terms of both more sophisticated equipment and highly-trained personnel, has created new problems in management. In many cases the officer's normal tours of shipboard duty do not prepare him sufficiently to step into a management role ashore. This is particularly true for the technically educated officer.

It is expected that an officer's graduate education in a technical field, with the resultant technical subspecialty code, will automatically make it more likely for him to be assigned to a billet where he will necessarily be brought into daily contact with the civilian scientists and engineers of that technical community, with other agencies of the Navy and the Department of Defense, with civilian universities and research facilities, and with military and civilian agencies of foreign governments. Unquestionably, a sound technical education in the particular field is mandatory if the officer is to function effectively in this environment; however, equally important is the officer's ability to manage effectively in this same environment. Captain Frank H. Featherston, a former project manager for aircraft and aviation systems development, writing for the U. S. Naval Institute Proceedings described the environment of the technical manager ashore:

> The project management environment ashore, invariably performed in Washington at the seat of government itself, is an adaptive, fishbowl world, lacking absolutes; where advice, scrutiny, and discourse between fractious coordinating elements flow together to create a never-ending

> crescendo of noise in the circuit of day-to-day deliberation and decision. To the project manager, a uniformed and obedient ship's company becomes instead a polygot technical crew of civil service specialists and contractor civilians, a sprinkling of military action officers in headquarters and at a variety of field activities, politically appointed and inspired civilian bosses, a continually-shifting flag rank hierarchy, numerous other executive branch officials, representatives of the news media, legislators and their staffs, and the General Accounting Office - all personages with allegiances and motivations completely foreign to the day-to-day operations of the USS OWN SHIP.[2]

The fact that Capt. Featherston was addressing the area of project management does not detract from his vivid description of the general working environment facing the technically educated officer.

The opinion that an officer gains valuable management background and experience while aboard ship is not disputed. However, it is contended that managing in the technical communities requires different management skills and a different type of management background - the kind of background that would not usually be gained through experience until the officer is more senior in rank (Commander or above). This type of background can also be attained in part, and significantly upgraded, through formalized management education.

When the subject of formalized management education for oceanography educated officers was discussed with military and civilian officials in the Oceanography Department of the Naval Postgraduate School and with officers in the Oceanographer of the Navy's office, all agreed that such educ tion

was desirable. Further discussion revealed, however, that significant problems existed in programming oceanography educated officers into formal management curricula, such as are taught at the Naval Postgraduate School. Although the problems of budgetary limitations, availability of management curriculum quotas, and divergent career desires of the officers concerned are significant in themselves, the primary problem appears to be the non-availability of officers, i.e. the difficulty in finding officers who can be released from other oceanographic duties to allow them sufficient time to complete a formal management program. This difficulty arises because the oceanography community is new, relatively small and not yet up to its planned end strength of officers.

Contrariwise, it is believed that the requirement for formalized management education in the oceanography community is sufficiently strong that some means should be found to provide a significant number of oceanography educated officers with additional education in management.

It is the purpose of this study to investigate, in greater depth, the requirement for formalized management education for oceanography educated officers and to identify in detail:

1. The oceanography billets which require a higher level, or special, management skills.

2. The particular management skills required.

3. The facilities and/or methods available for acquiring the management skills.

4. The level, or rank, at which it would be most beneficial for the officer to acquire these skills.

It is hoped that this study, in answering these and other related questions, will be a useful contribution to future oceanography planning, particularly with regard to the Navy programs in oceanography and their relationship to national interests.

A. DEFINITIONS

Some of the terms used in this study, while not in themselves confusing, can be interpreted in many different ways. The purpose of this section is to provide definitions of certain terms which are used frequently throughout this study.

Formal Management Education: Management education through enrollment in an established management curriculum, such as curriculum 817 at the Naval Postgraduate School, and for which academic credit is received.

Formalized Management Education: Management education received through means other than established management curricula and for which academic credit may or may not be granted. Examples of such programs include: the Defense Systems Management Course; the completion of selected courses in the management field during off-duty study or while engaged in studies in other educational fields; and training programs or indoctrination courses utilized to prepare an officer for assignment to a specific billet.

Oceanography Specialist: The officer who, "because of his personal desires and qualifications as determined by a selection board, pursues his career solely in areas related to oceanography." [1] The specialist, officially designated Special Duty Officer (SDO) (Geophysics-1820), usually has completed postgraduate education in oceanography or hydrography, but such education is not a requirement. This officer will be referred to, variously, as "the specialist" or "the 1820 officer" and is included in such group terms as "oceanography educated officers," which are defined below.

Oceanography Subspecialist: The officer who has completed postgraduate education at the Master's level and has been assigned either the 8710P (Oceanography) code or the 8720P (Hydrography) code. Such officers will be referred to as "the subspecialist" or "the P-coded officer" and are included in the group terms "oceanography officers" or "oceanography educated officer," defined below. It should be noted that, while the majority of 1820 officers also carry the 8710P subspeciality code, the term "subspecialist" will refer only to non-1820 officers.

Oceanography Officer/Oceanography Educated Officer: Inclusive group terms used to indicate, collectively, the oceanography specialists and subspecialists. Those few 1820 officers who have not had advanced oceanography education are, nevertheless, included in the term "oceanography educated officer."

II. MANAGEMENT AND THE TECHNICALLY EDUCATED OFFICER

> Our defense world today is one of vast explosions of knowledge about science, medicine, social structures and almost any other conceivable area of interest. Add to this, the complexity (and cost) of modern weapon systems, the competing claims for national resources and the changing value structure of our society, and you've got problems! To put it bluntly, we in Defense are being forced to face a picture of declining resources over the foreseeable future, where we must do better at getting the maximum results from the resources we have available. [3]

This is the way Professor H. Paul Ecker, Director of the Navy Management Systems Center, U. S. Naval Postgraduate School, describes the existing environment in which the Department of Defense must operate. Professor Ecker has stated the essence of a problem that has grown in magnitude over the past decade - the problem of effective management.

The "explosion of knowledge" following, or perhaps as a direct result of, World War II, particularly in the sciences, has caused significant increases in the complexities of military equipment and significant demands upon the men who design, operate and maintain this new equipment. Likewise, the management associated with these new defense systems has necessarily gone through several phases of evolution, from the analytical and systems planning approaches of the early Sixties to the Planning, Programming, and Budgeting concepts of the early Seventies.

Within the Navy, the growing need for technically educated officers to cope with the knowledge explosion was recognized and, with the establishment of the Naval Postgraduate School

in 1948 as a separate activity with degree-awarding authority, the fulfillment of this need was initiated. It wasn't until 1962, however, that the advanced education of officers received its real impetus when a major internal reorganization made the Naval Postgraduate School, in effect, "a naval university, unified in policy, procedure and purpose." [4]

On the other hand, it has only been during the past several years that the Chief of Naval Operations and other high Navy officials, while continuing the emphasis on the need for technically educated officers, have placed increasing importance on knowledge of formal management tools and techniques for a much broader range of naval officers. In order to evaluate this change in policy, one must consider the effects of this recent stressing of management on the Navy in general and on the technical communities in particular.

A. INCREASING EMPHASIS ON EFFECTIVE MANAGEMENT

The indications of the increasing emphasis on effective management, aside from the large numbers of officers being assigned to the Management Curriculum at the Naval Postgraduate School, are perhaps most dramatically demonstrated by the elevation of managerial expertise to an equal status with operational expertise: "In view of the forced reduction of forces, and the increasing need for top management expertise ashore, it has been recognized that there is need for a managerial as well as an operational route to promotion.

Correspondingly, there is a need to identify and appropriately recognize certain shore and managerial positions as equivalent, in overall importance to the Navy, to command at sea." [5] This same article in the BUPERS Newsletter went further to state, "Selection boards will be carefully briefed, and precepts carefully written, to ensure the viability of both promotion paths." [5] This is a remarkable change in policy when one considers that, until this time, a necessary intermediate goal of any Unrestricted Line Officer (URL) aspiring to flag rank was command at sea.

Unfortunately, this change in policy is also one that many officers, particularly more senior officers, find difficult to accept. This non-acceptance probably stems from misunderstandings or misconceptions of management in the military. Too often the term "management" is equated to reductions in personnel or equipment, to so-called "efficiency experts," or perhaps to disconcerting visits from the General Accounting Office. More properly, management should be considered in the context of getting more out of what you have. In the spectrum of management science, one function that stands out from the rest as the dominant theme is "the ability to get the job done." [6] In this sense, it is suggested that the terms "manager," "administrator," and "executive" are synonymous.

It will be stated now, and repeated throughout this study, that management education, of whatever type or duration, is

not being promoted as a cure-all that will single-handedly solve the Navy's personnel, monetary, and equipment problems. Rather, such education should be viewed as stated in the Naval Postgraduate School Management Curriculum objectives: "To provide officers with increased education in Management which will improve their capabilities for organizing, planning, directing, coordination and controlling activities in which the resources of men, money, and materials are combined to accomplish Navy objectives." [4] Of course, the key words here are "improve their capabilities." It should be noted that the objective specifically avoids the subject of creating "management experts."

It must also be stated that, at no time, is the suggestion made for a reversal of the trend toward providing a broader base of technically educated officers, nor is a return to the old "General Line School" concept of education for officers advocated. It is necessary that many officers be educated in technical disciplines, many in management disciplines, and a substantial number in both.

On 9 July 1971, the Chief of Naval Operations issued a policy statement on officer specialization which covered the subject in detail:

> "...There has and will continue to be a need for generalists, but there has developed a more definite requirement for the specialist as well. This requirement includes command-at-sea billets, which can be filled by either the generalist or the specialist, but exists principally to meet our shortages ashore of experts needed for the evaluation and development of oncoming weapons systems,

new tactics, force levels, and long range plans.... To adjust to these conditions, we have formulated the spectrum approach to officer career development. We need highly talented URL officers with various mixes of operational and managerial experience concentrated in certain subcategories of the naval warfare and related supporting activities.

"...(With regard to subspecialists) Again the goal is for a spectrum of career paths with some officers highly specialized, some very generalized, and many mixes in between." [7]

Given the increased emphasis on management expertise, what procedures are available to the Navy to assist in implementing this change in policy? What problems confront the Navy in general and, more specifically, the oceanography and other technical communities, and what can be done to bridge this "management gap"?

B. PROBLEMS IN BRIDGING THE MANAGEMENT GAP

The stress on managerial career paths and the specific briefings to selection boards, discussed previously, serve to recognize the need for and elevate the status of managers in the military. However, this added recognition, although a very necessary and important first step, does not in itself produce the required number of new and effective managers. Some programs for the education of managers already exist and will be discussed in detail in the next section of this study.

It should be noted at this point that, while the existing management programs (e.g., the Management curriculum at NPS) are being utilized to capacity, the primary problem of concern to this study is that technically educated officers are

seldom assigned to them. The officers completing these programs will, undoubtedly, put their management education to good use, and informal discussions with graduates indicates this is, in fact, the case. But the need for officers educated both in a technical area and in management continues unfulfilled. Comments on a study concerning future professional manpower requirements included a statement which supports this conclusion: "At the Postgraduate School I foresee some reemphasis on technical manpower needs and in better understanding of the now popular wishes for managers. The Navy has some tough managerial problems ahead that cannot be handled by men who have had management but don't understand the complex technical world they are managing." [8]

Other significant problems stand in the way of developing a cadre of technical managers, and one that must be placed high on the list is the general attitude, conscious or unconscious, of many senior officers toward the technical specialist and the manager. Although the specialist, or Restricted Line officer, is no longer looked down on to quite the degree as was prevalent a decade ago, there is still the reluctance to elevate the specialist to entirely equal status with the generalist, or Unrestricted Line officer. Another respondent commenting on the professional manpower requirements described the situation:

> As a result of some intensive effort in the proposed reorganization of NAVMAT (Naval Material Command), I h ve

> become convinced that the Navy of the future will have a desparate need for engineering managers in the restricted line. But I do not believe that these needs will ever be met because of a refusal on the Navy's part to recognize that the men that will fill these needs must have an opportunity to command. So long as the paranoia exists among our senior unrestricted line that the well qualified unrestricted officer can do anything and that the restricted line officer is not to be trusted in positions of command, we will remain in trouble. [8]

Managers are held in much lower regard than even the specialist and, in some cases, are looked down on by the specialist. Unfortunately, the necessary changes in attitude will not come easily, but only with time and with a sufficient number of outstanding performances by managers serving in responsible billets.

This problem of attitude change in turn creates additional problems, such as the reluctance of commanders to identify billet requirements for either technical or management P-coded officers. This subject will be discussed in the next section and will be followed by discussions of two other significant problem areas.

1. The P-code Billet Structure

The purpose of P-coding billets is, very briefly, to identify those billets to which it is essential to assign officers with a Master's level education for optimum performance of duty. [9] Quotas for postgraduate education are based on the number of validated P-coded billets, and the validation is the responsibility of the operational commander. [9] The problem is that, "in the past, there has been a

reluctance among operational Commanders to P-code billets. Their rationale has been based on avoidance of restricting the number of eligible candidates to those who have had postgraduate education at the expense of those outstanding officers who have not." [1] This problem of identifying, or validating, billets has been the subject of much recent correspondence in the Navy, including a Navy-wide review of subspecialty-coded billets. [10] The subject will not be pursued in this study, except to point out its adverse effects on the oceanography community.

The reluctance to identify oceanography P-coded billets was formally addressed, with special regard for billets associated with Antisubmarine Warfare, by the Oceanographer of the Navy in 1966 and again in 1971, by the Superintendent of the Postgraduate School in 1969, and by the Chief of Naval Operations in 1970. [1] In 1971:

> The Oceanographer of the Navy also sent a special written appeal to all Commanders, Commanding Officers, and Officers-in-Charge of key ASW/USW activities and requested them to review their billets and attempt to identify those in which an oceanography subspecialist could render optimum performance of duty. This was addressed to about 300 commands and activities - air, sea, and submarine, and also included research and development activities, laboratories, and Fleet Schools. ...Although the deadline for survey submissions has passed, there has not been an appreciable increase in the requests for oceanography subspecialist billets. We are anticipating recognition at the operational squadron, ship and aircraft level, but this has not been forthcoming. [1]

This appeal coincided with the Navy-wide review of P-coded billets. The survey has since been completed and, despite

this special appeal, so few additional oceanography billets were identified that continuation of any oceanography curriculum at the Naval Postgraduate is in jeopardy! [11]

Although specific effects of the billet survey with respect to management P-coded billets is not known at this point, it is assumed that identification of oceanography-management billets would meet with at least equal resistance. In this regard, since only in very exceptional cases would a billet carry both an oceanography P-code and a management P-code, some other means must be found to specify those oceanography billets which require the managerial expertise. This could perhaps best be done by use of management Naval Officer Billet Classification (NOBC) codes for the particular oceanography billets. These NOBC's are general billet descriptions and are explained in Appendix B. The meteorology community (1810 designator/8610P) already uses this means to identify information management and personnel management billets. [12]

2. Lack of Management Experience

This problem area refers to the lack of experience in technical management tools and techniques, as discussed in the opening pages of this study.

The point that technical management, usually ashore, involves a different set of managerial problems than management of some department or division of a ship was considered

early in this study. The very nature of the operational career pattern normally prevents the officer from gaining the skills required for technical management ashore. A typical career pattern might be an initial sea tour of 3 - 5 years, followed by a two-year tour ashore in one of a wide variety of Navy staff billets, followed by a second sea tour. By this time the officer has reached the rank of Lieutenant Commander. If the officer attended postgraduate school in a technical curriculum, a common occurrence, the pattern is normally unchanged. Desiring to remain completely competitive with his contemporaries who served their shore tours in operational billets, the officer specifically does not request a billet in his new subspeciality. This is particularly true in the oceanography community because of the low number of P-coded billets overall and the extreme paucity of billets that would be "career enhancing."

Following his second sea tour, the officer could now "afford" a duty assignment in his subspecialty of oceanography, but preferring that it be with a large Navy staff or command. The billets available at this level are about equally divided between technical management and applied technical (such as Environmental Forecaster or ASW Instructor). The readjustment period at this level is made difficult because the decrease in proficiency resulting from the time away from the rapidly changing field of oceanography is superimposed on the lack of management education that would

permit easier adaptation to this different working environment. Should the officer wait until the rank of Commander, or later, to first serve in a subspecialty billet, the difficulties are substantially magnified and it becomes even more imperative that the officer be provided with some type of formalized management education, particularly in view of the fact that the billets are almost 100 percent management at that point.

The same reasoning can be applied, for the present, to the specialist in the oceanography community. The qualifying words, "for the present," are used here because of the nature of the oceanography specialist corps at this point in time. The oceanography specialist community has only had a few years to develop and, at present, there is a severe shortage of 1820-designated officers in the ranks of Captain and Commander, and many of the 1820 Lieutenant Commanders have not yet completed their first tour as oceanographers. Again, approximately 50 percent of the Lieutenant Commander and nearly 100 percent of the Commander and Captain specialist billets are management oriented, so the reasoning used above for the subspecialist also holds true for the specialist. It is hoped that, with the adequate number of 1820-designated Lieutenants presently available, enough of them will have served in oceanography billets and a sufficient number will have been assigned to some sort of formalized management

program, that the readjustment period will be minimal. The main area of concern in this regard, in view of the problem of identification of validated P-coded billets, is maintaining the 1820 Lieutenant strength at full capacity.

3. Absence of Management/Administrative Education

This problem area refers to the general absence of a formal management or administrative educational background for the average naval officer. The following comments apply equally whether the officer is a specialist or a subspecialist.

The number of naval officers possessing undergraduate degrees in management, administration, business administration, or similar disciplines is limited, and such education may well be outdated in the 8-10 years between the time of study and the time the officer would be assuming a management position. Considered from another point of view, the major source of oceanography educated officers is the Naval Postgraduate School, and requirements for admittance to a technical curriculum dictate certain levels of undergraduate study in mathematics and the physical sciences, levels not normally reached in non-technical undergraduate curricula. In any case, the requirement for formalized management education will exist.

Further, consideration must be given to the present nature of the oceanography community, i.e., a relatively new community with officer shortages in the upper ranks. Within

these upper ranks are the technical managers and administrators of the Navy's oceanography programs. Any formalized management courses that these officers may have had as undergraduates, particularly those who attended the U. S. Naval Academy, is severely limited. Included in this category are USNA graduates of 1960 or earlier classes (senior Lieutenant Commanders presently), who did not study under the revised Naval Academy curricula which permits majoring in specific technical or non-technical fields. Methods must be developed to provide these officers with the required management skills in order to make the Navy oceanography programs as effective as possible. Several such methods, or proposed methods, will be discussed in detail in later sections.

For the remainder of the officers, Lieutenant Commander and below, in the oceanography community, it is hoped that their undergraduate studies included sufficient management/administration courses to allow reasonably effectively performance in those technical manager billets that do exist in the lower ranks. It is also hoped that they will routinely, in the future, be programmed for formalized management education at suitable times.

C. BRIDGING THE MANAGEMENT GAP: SOME EXISTING PROGRAMS

In addition to repeated stressing of Navy needs for officers with managerial expertise and the briefing of selection boards to ensure equal consideration for managers, several other steps have been taken by the Navy in an effort to bridge the management gap. While some of the programs described below are relatively new, others have been in existence for many years but have recently been upgraded in status. Brief comments will be made concerning each of the described programs and specific applications to the various technical communities will be noted.

1. Increased Enrollment in Management Curriculum.

By the end of 1971, more than 1200 officers had received Master of Science degrees in management from the Naval Postgraduate School. The number of quotas in Management averaged approximately 100 per year until 1965, then quotas steadily increased to over 200 in 1970. [4] Inputs of officers to this program remained near 100 percent of available quotas until mid-1969, after which inputs exceeded quotas by 10-15 percent each year. [13] (In contrast, technical curricula enrollment has averaged 40 percent below available quotas since 1969.) Unfortunately, very few of the officers assigned to the management program have had previous advanced education in a technical area, and only one oceanography educated officer has been so assigned.

2. Combined Technical/Management Curricula.

These programs indicate the efforts of two technical communities, namely, Communications and Computer Systems, to provide some officers with both basic technical and basic managerial backgrounds. Both programs provide approximately equal numbers of courses in the technical speciality and in management.

a. Communications Management

This program, which replaced the non-degree Staff Communications Course in 1970, has apparently been successful in that it has encouraged larger numbers of graduating officers to request communications billets with large commands and staffs, and feedback comments from staff commanders are very favorable. [14] It is interesting to note that more than twice the number of officers are being educated in this program as are being educated in Communications Engineering.

b. Computer Systems Management

This program, and its technical counterpart, Computer Science, have both tripled in size since their inception 3-4 years ago. However, the enrollment in Computer Systems Management is three times the size of that for Computer Science, and in 1970 the enrollment was approximately 60 percent above the assigned quotas. [13] Opinions as to the effectiveness of this program, however, are varied. The results of an analysis of the educational materials which should be included in a postgraduate curriculum designed to prepare officers for automatic data processing related middle

management positions in the Navy indicated that the broader concepts of management and administration should be emphasized instead of the details of computer operations. [15] Specifically, questionnaires were sent to graduates of the Computer Systems Management curriculum soliciting their opinions on a wide variety of subjects and areas studied. The results of the questionnaires indicated that the areas that ranked highest with regard to value/usefulness but lowest with regard to adequacy of preparation were overwhelmingly in management and administration, and included such areas as: Navy civilian personnel policy and practices; design and administration of training programs; identification of cost elements and benefits; methods of evaluating personnel performance; and feasibility studies and concepts. [15] These results seem to provide an argument against a combined program; however, it also appears that similar studies would have to be conducted for graduates of the Computer Science curriculum and the Management curriculum, serving in similar billets, and comparisons of the three studies made before a final determination could be reached.

Whether or not a combined program would be effective for the oceanography educated officer will be discussed in some detail in a subsequent section of this study. However, it is believed that such a program might be desirable, or even ideal, for an officer who receives his

oceanography education later than normal in his career, i.e., at the senior Lieutenant Commander or Commander level.

3. Relevant Management Courses in Technical Curricula.

Although this procedure exists in nearly all curricula at the Naval Postgraduate School (the Environmental Sciences curricula are among the few exceptions), the courses are, in general, so few in number that, while certainly useful, can hardly be considered significant preparation for assignment to a technical manager billet. A possible exception is the Aeronautical Engineering curriculum in which one management course is programmed, three management electives are directed, and one "free" elective is available. [4] In contrast, the Oceanography curriculum provides for only one elective, and that is required to be filled by one of two designated Oceanography courses.

Government and Humanities courses, while normally taught as a part of undergraduate programs, do have a certain relevance to future technical managers. Prior to 1971, graduate students were permitted to take these courses only on a non-credit basis; however, a significant number of courses (15) are now available to graduate students for credit, and several new courses, specifically designed for graduate students, have been established. [16] Most notable of these new courses is the one entitled: "International Policy Issues Pertaining to the Environmental Sciences." This course is highly recommended for all Environmental Sciences students.

4. <u>Systems Acquisition Management Curriculum.</u>

Established in 1971, this new program has the stated objective: "To provide selected officers with an advanced education in the fundamental concepts, methodology, and analytical techniques required for the life cycle management of planning and acquisition of defense systems." [4] The purpose of this program is to create a pool of well trained officers from which the Navy may select their future project managers [16], but the program is considered relevant for oceanography educated officers because of the several project officer type billets for oceanography specialists and subspecialists. It becomes even more relevant if viewed in the broader perspective:

> This program encompasses development of what used to be called "Project Managers." The complex and critical logistic programs of the Navy dictate the establishment of a viable program for development of individuals who have a combination of professional leadership ability, management experience, technical knowledge, and operational experience. The overall goal is not to create a new restricted line officer or staff corps officer but rather to provide a community made up of officers from all specialties who have the knowledge and capability to manage at a truly professional level within today's competitive technological arena. [17]

5. <u>Defense Management Systems Course.</u>

This course, designed for Commanders and above, could prove to be one of the most versatile means available for closing the management gap. The purpose and objectives of the course are as follows:

Purpose. Fulfill Department of Defense requirements for educating high level military and civilian personnel working in planning, programming, budgeting, systems analysis or resources management activities of Departmental or Agency Headquarters, and selected major commands.

Objective. To provide an appreciation of the concepts, principles, and methods of defense management as they concern planning, programming, budgeting, and related activities. The course covers force planning, Department of Defense programming, program budgeting, and their interrelationships with resource management systems. Emphasis is placed on the analytical aspects of management, including requirements, studies, systems analysis, cost effectiveness, cost estimating and analysis. [4]

The objective is accomplished by taking an interdisciplinary approach utilizing 70 hours of lectures, plus discussions, case studies, and problem solving. [18] The versitility of the course results from its short length (4 weeks), its frequency (8 times a year), and its location (both east and west coasts). If used to its full advantage, this course could be of great benefit to all technical communities, but particularly to the oceanography community wherein the lack of sufficient officers in the ranks of Commander and Captain make it difficult to program these officers for longer periods of schooling.

Up to this point, discussions have been directed at outlining, in fairly broad terms, Navy needs, problems, and programs associated with effective management and administration, with particular regard given to the technically educated officer. The oceanography community, although mentioned only briefly in foregoing discussions, has specific needs and problems in management and administrative areas, and these will now be investigated in detail.

III. MANAGEMENT AND THE OCEANOGRAPHY OFFICER

The oceanography community, like the rest of the Navy, is faced with the problems of reduction in force, budgetary limitations, and a growing, and sometimes very vocal, public sentiment against things military. These problems are made somewhat more difficult for the oceanography community because of its relative newness and its attempts to establish some sort of organizational stability and plan for orderly growth to a required end-strength while, at the same time, facing personnel reductions and cuts in operating funds. Even with the increased recognition of the importance of oceanography to the Navy, directed reductions, on the order of 25 percent, in the size of major staffs [19] could be a serious blow to the planning and implementing of future oceanographic programs. The oceanographic planning and programming offices, the Office of the Oceanographer (OCEANAV) and the Naval Oceanographic OFFICE (NAVOCEANO), are already operating undermanned with regard to senior 1820-designator officers as shown below:

Table 1. Senior 1820 Officers at OCEANAV and NAVOCEANO [20]

	Total Billets	Total No. of Officers	No. of Billets OCEANAV/ NAVOCEANO	1820 Officers Serving in OCEANAV/NAVOCEANO
Captain	10	5	8	3
Commander	21	11	7	5

With this potentially serious undermanning and since all of the above OCEANAV and NAVOCEANO billets are management/ administrative, it is even more imperative that the senior officers be the most effective managers and administrators possible. Because the other segments of the Navy are absorbed in maintaining their own status and viability, the oceanography community can expect little assistance and must look out for itself by establishing its own plans for developing individuals who, in the words of the Chief of Naval Operations, have "a combination of professional leadership ability, management experience, technical knowledge, and operational experience." [7]

In spite of the problems mentioned above, the oceanography community may possibly be in a more advantageous position than many other technical communities <u>because</u> of one of the problem areas - that is, the growing public sentiment against things military. The military is presently on one of the downswings of its periodic popularity cycle, and any program that will have a tendency to assist in reversing this downswing should be fully exploited. The oceanography community is in an advantageous position to participate in several areas that are presently receiving extensive public attention and governmental consideration. These areas include ocean and harbor pollution, marine ecology, and waste disposal. The Chief of Naval Operations discussed these problem areas in July 1972.

> Because the Navy has the most complex environmental challenge with operations ashore, at sea and in the air, it has been a leader in National efforts to preserve our environment for future generations. The Navy's $1.5 billion program for the next five years is designed to contend with known environment hazards. [21]

On the other hand, exploiting any small advantage that exists will require a most delicate touch by the manager-administrator and a substantial knowledge of higher level management tools and techniques, including economics, public relations, and "a frank appreciation of governmental working relationships and past Navy dealings with Congress." [2]

> The responsibility of the oceanographic management in the Navy is to insure timely attention to the problem areas in accordance with their priority. The Navy's effort in oceanography not only contributes to its primary mission of National Defense but inevitably makes sizable contributions both to general oceanographic knowledge and to the attainment of other National Marine Science Program goals. Additional spin-off benefits include contributions to broad scientific, economic, and political objectives in furtherance and protection of U. S. maritime interests. [22]

RADM W. W. Behrens, Jr., former Oceanographer of the Navy, elaborated on this broad policy statement during his "Keynote Address" to the 8th U. S. Navy Symposium on Military Oceanography in May 1971 and listed what he considered to be four highly important factors affecting future oceanographic planning:

1. International cooperation
2. Establishment of the National Oceanic and Atmospheric Administration (NOAA)

3. Widespread increases in awareness of the complex relationship between man and his environment
4. Economic attitude of the country [23]

It is pointed out that none of these factors are studied in advanced oceanography education, at least not in the Naval Postgraduate School curriculum. Each factor does, however, point out a specific area in which the oceanography educated officer should be knowledgeable. Respectively, these areas are cooperation with foreign countries, cooperation with other Federal agencies, public relations, and economics. The first two of these areas are discussed in a later section entitled: Navy Oceanography Cooperation with Other Agencies.

With regard to the third item, man and his environment, RADM Behrens stated:

> The first wave of concern about the fragile quality of our environment has generated some difficult problems for the Navy and the nation that must be addressed in some manner acceptable to all concerned. But it is evident that while the Navy may be part of the problem, we are also prepared for, and capable of, significant contributions to far-reaching solutions - beyond the scope of our mission responsibilities. [23]

This is the idea referred to previously with regard to oceanography's small advantage over most other technical communities - the capability to help solve civilian problems. The Navy's oceanography community can take the lead in solving military and civilian problems in areas such as ocean pollution and ecology. RADM Behrens also cited specifically cooperation with the new national Environmental Protection Agency and the

establishment of a new staff function in the Office of the Oceanographer under the Environmental Quality Division. This new division "will function as the office through which the Oceanographer can respond to the Chief of Naval Operations, and others, who ask for our support." [23] That such support will be requested is evidenced by a recent "Z-GRAM" from the Chief of Naval Operations emphasizing environmental protection equipment on ships, development of a program of ecological principles and actions to help guide future efforts, and the establishment of an "Ecology Spot Report." This report will "provide the government with additional information in the struggle against self-destruction of our environment." [24] In order to meet these support requirements, the oceanography community must have officers who are well-versed in the technical aspects of solutions to pollution problems. They must also be experienced in liaison with other Federal and civilian agencies.

With regard to the fourth factor affecting oceanographic planning, the economic attitude of the country, RADM Behrens termed this the "ultimate influence." He cited budget reductions which required the oceanography community to operate with less money in 1971 and 1972 (20% and 13% less, respectively) than in 1970, and reemphasized examining ways to operate more efficiently - "sometimes with less personnel, or by making painful selections of projects to be set aside as not leading

directly to satisfying urgent requirements." [23] The need for good managers and administrators to operate efficiently in this restricted monetary environment should be readily apparent. It should also be recognized that there is an urgent need for officers, with both the technical background and the managerial expertise, to sell and keep selling oceanography to the Navy, the military, and the nation.

In order to better understand the management needs, problems and programs of the oceanography community, it is necessary to consider the oceanography areas in which the Navy is involved or can be expected to become involved.

A. NAVY OCEANOGRAPHY PROGRAMS

Presently, oceanography in the Navy is divided into four major areas:

1. Environmental Prediction
2. Operations (Mapping, Charting, Data Collection, and Oceanographic Support)
3. Ocean Engineering
4. Ocean Science (Research and Development) [22]

Each of these areas will be considered separately and in detail following general remarks regarding oceanography programs with specific discussions in the area of management. In considering these four major areas, frequent reference will be made to two Navy Professional Manpower Forecasts. One of these is for Environmental Science (Oceanography) [25]; the other is for

Ship Engineering (Ocean Engineering was a part of the Ship Engineering forecast and not Oceanography). [8] The forecasts involve a series of questionnaires which were addressed to selected experts in specific fields to gather their opinions in a form that will be useful in projecting future requirements for officers and civilians educated at various levels and in appropriate fields of academic achievements." [25] The forecasts and questionnaires are explained in more detail in Appendix D, which also includes specific respondent's comments of particular relevance to this study. Briefly, respondents commented on relative expansion or contraction of current manpower requirements, new academic courses or degree fields, and emerging occupational fields. A set list of assumptions was provided with the questionnaires and it is interesting to note that, for both forecasts (Oceanography and Ship Engineering), more than 25 percent of the assumptions concerned areas discussed in this study - technical management, economics, international relations, and cooperation and coordination with other agencies.

1. Environmental Prediction

The major area of Environmental Prediction is primarily concerned with oceanographic forecasts in support of naval operations. It involves such factors as: air-sea interaction; atmospheric and oceanic circulation; ocean currents, waves, and temperature distributions. [22] Fleet Weather

Centrals serve as collection points for environmental data and, after data analyzation, disseminate environmental predictions, including acoustical forecasts, to fleet units. Significant cooperation and coordination is necessary between the Navy and other military, national, and international agencies.

The oceanography curriculum at the Naval Postgraduate School is presently devoted almost entirely to education officers in this area and it is, therefore, appropriate at this point to consider the number and type of specialist and subspecialist billets concerned.

Table II. Environmental Prediction Billets for Oceanography Officers [21]

	Specialist	Subspecialist
Lieutenant Commander	4	1
Lieutenant	4	2
Total	8	3

These billets, which are explained in detail in a following section, (also refer to Appendices A and B for billet titles and descriptions), are billets at Fleet Weather Centrals. Two other billets carry "meteorology" classifications, but both are "user" type billets and not strictly environmental prediction in nature. These billets are Head of the ASW Support Division at Naval Weather Service Command Headquarters (LCDR), and ASWEPS Officer on the COMCRUDESFLOT 2 Staff (LT).

This heavy emphasis on Fleet Weather Centrals is expected since the Assistant Oceanographer for Environmental Prediction is the Commander of the Naval Weather Service Command - the meteorology specialist and subspecialist community.

Several other billets (two LCDR, three LT), in a sense, are associated with environmental prediction in that they are billets for aviators with an oceanography subspecialty, who pilot aircraft involved in environmental prediction special projects. There are also several other "user" billets, but these are Staff Oceanographic Officer billets with large commands which have separate meteorology specialist billets. Here environmental prediction advice is only a part of the oceanography officer's total function. (See Appendix B for descriptions of billets).

In considering management requirements for this area, with its emphasis on meteorology, it is interesting to look at what meteorologists have been doing for the last decade:

Table III. Employment of Meteorologists, 1960-1970 [26]

		1960(*)	1970(*)	Rate of Increase (#)
1.	Research & Development	17% (635)	18% (1228)	92%
2.	Forecasting & Reporting	45% (1700)	33% (2193)	45%
3.	Teaching	5% (184)	7% (467)	125%
4.	Management/Administration	21% (819)	27% (1755)	110%

*Numbers of personnel
#Rate of increase in total personnel

The numbers shown are total meteorologists in military, national, and civilian programs. Approximately 67 percent, equally divided between military and non-military, are employed by the government or depend on government funds for their operation.

Although this study is not intended to be overly critical of the oceanography curriculum taught at the Naval Postgraduate School, the relatively small percentage of officers (less than 10 percent of the specialists and less than 25 percent of the subspecialists, even if the aviator and "user" billets are included) engaged in environmental prediction hardly justifies maintaining the rigid environmental studies program. The above is especially true if this program acts to the detriment of other phases of oceanography, such as hydrography, underwater acoustics, ocean engineering, and the management/administration requirements. The Curricular Officer for Environmental Sciences at the Naval Postgraduate School has expressed similar views:

> "Most operational billets on paper are in the Lieutenant and below grades. Few Oceanographers are educated in these lower ranks, so most operational billets result in being billets under the control of the Naval Weather Service. The officer apparently has an over-kill in Oceanography to apply his knowledge to the limited operational requirements of the Naval Weather Service structure, yet has few billet outlets within the Oceanographer's structure other than in Administration or R&D work." [27]

Of the comments in the manpower forecasts, referred to earlier in this section, less than two percent concerned

Environmental Prediction as a topic. However, more than 20 percent of the comments concerned ASW and acoustics, areas that have received much attention in the past several years, but which are only given a broad-brush treatment in oceanography curricula. More than one-third of the comments were directed to the field of Hydrography, the subject of the next section. [25]

2. Operations

This area of oceanography involvement includes the mapping, charting, and geodesy functions of hydrography, data collections, and oceanographic support in areas such as underwater search, recovery, rescue and salvage. At the time of this writing, plans and programs in this area were the responsibility of the Naval Oceanographic Office, but these functions are expected to be transferred to the new Defense Mapping Agency.

Present and future programs were described by the Commander, Naval Oceanographic Office, and by the Assistant Oceanographer for Operations at the 8th U. S. Navy Symposium on Military Oceanography in May 1971, and are quoted below. The need for managerial and administrative expertise, although not stated in specific terms, is clearly illustrated and should be noted with regard to foregoing discussions in this study.

> Many naval operations depend, and probably will continue to depend to a significant degree on geophysical data.

NAVOCEANO for 140 years has been the Navy's prime collector of these data. We continue to operate more survey platforms than any other U. S. organization and maintain close liaison and exchange programs with most of the world's major hydrography/oceanographic organizations. ...Within the past year NAVOCEANO has become increasingly involved in the broad environmental problems concerning the Navy and the nation relative to disposal of munitions and warfare chemicals in the ocean.

We have also performed an analysis of the historical environmental data for one site and have conducted a biological evaluation of all currently proposed sites from the commercial fisheries standpoint. In addition, we have furnished an expert backup witness for Congressional hearings on the project CHASE operations involving the Army's nerve gas disposal.

...During the past year we have evaluated our capabilities with regard to pollution detection, control, and abatement in response to requests from CNO. As a result of this appraisal we have submitted proposals for study of scientific pollution problems by NAVOCEANO - for the simple reason that we think we have the best existing capability in instrumentation and trained personnel in the Navy. [28]

...My responsibilities as Deep Submergence Systems Program Coordinator are: set policy, coordinate Planning, Programming, and Budgeting (PPB), set requirements and priorities, appraise performance, certify operations, assist in SAR, ...

For the most part our operational deep submergence systems are the fruits of the fine efforts of people working in programs under the cognizance of these two assistant oceanographers (Ocean Science and Ocean Engineering). They research, engineer, and develop the systems. People under my cognizance operate them. We act as a broker for the Deep Submergence Systems Program by maintaining a wide group of contacts. Hardly a week passes that industry isn't telling us what they can do; and others are setting forth requirements.

...I envision extensive opportunities in support of the expanding subterranean oil industry; I foresee a requirement to assist in policing the deep ocean in support of disarmament agreements; I predict that the Deep Submergence Program will make a significant contribution to the Nation's attack upon pollution problems. There is enough research work in the deep oceans to keep us busy for a hundred years. [29]

The oceanography curriculum at the Naval Postgraduate School does not provide for educating officers in this Operations area of involvement, except in the very broad manner of providing general background material in much the same way that Physics and Mathematics do for any technical curriculum. This being the case, then it is appropriate to now look at the number of oceanography specialist and subspecialist billets in this area.

Table IV. Operations (Hydrography and Oceanographic Support) Billets [21]

	Specialist	Subspecialist
Captain	4	-
Commander	7	1
Lieutenant Commander	9	-
Lieutenant	11	-
Lieutenant Junior Grade	13	-
Total	44	1

The listing of billets in this area was based on billet titles, descriptions, and classifications, and on personnel communication with officers who are serving, or who have served in these billets. Included are the majority of billets in planning and programming at the Naval Oceanographic Office, which is responsible for this area of involvement. The listing indicates that nearly 30 percent of the oceanography specialist billets are in this area. This percentage

should certainly provide some justification for including specific hydrography and ocean support courses in an oceanography curriculum.

The manpower forecast listed only 12 billets for officers in the field of hydrography; however, this number was based on billets which are listed as requiring the hydrography P-code (8720P) and was not based on actual billet descriptions or functions. Of interest, this number of billets (12) does not check with the Annual Officer Billet Summary published by the Bureau of Naval Personnel, which lists only five 8720P billets. [12] This discrepancy would have little effect, however, on the substantial concern for the field of hydrography shown by the manpower forecast comments.

As will be detailed in a later section, the majority of the billets in the area of Operations are management or administrative. This is primarily because of the number of senior officer billets at the Naval Oceanographic Office.

3. <u>Ocean Engineering</u>

At the 8th U. S. Navy Symposium on Military Oceanography, RADM T. E. Davies, Assistant Oceanographer for Ocean Engineering and Development, described recent and future developments in this field:

> All relevant military R&D must start with and be guided by a strategy. For Ocean Engineering that desired goal is to attain full utilization of the ocean environment in support of national security. Or, more specifically stated, we must provide the Navy with the capability to operate at any time and place within the ocean environment. But in the

structuring and management of a program, it is necessary to become more specific, and this broad objective must be related to mission requirements.

The spectrum varies from long standing missions in surveillance, to recent requirements for search and rescue, on to much more futuristic goals of policing and neutralizing undersea installations. With the establishment of missions, the next step is the identification of the capabilities required for these tasks.

Capabilities require materials and equipment which in turn must be fed by technology development - specifically in areas of critical deficiencies. Thus, the Ocean Engineering Program is guided by these two factors - capability requirements and technology deficiencies.

...I would like to emphasize that although our ocean engineering capabilities are aimed directly at supporting the Navy's requirements for National Defense, those same capabilities support other National needs in the areas of laws, security, resources, and science. Legal problems in off-shore operations will be eased by our ability to establish and inspect such installations. Commercial applications of Navy developed surveying and prediction techniques will provide invaluable capabilities to industry and other governmental agencies. Most important, our broad, expanding technology base represents a significant contribution to our nation's overall scientific knowledge and ocean engineering capabilities. [30]

This description again serves to reinforce the argument for management education for the oceanography officer.

It should be noted that the foregoing discussion did not completely describe the functions and goals of Ocean Engineering. Perhaps this is so due to the fact that Ocean Engineering is somewhat of an anomaly at the present time, and there is much controversy as to whether this field "belongs" to the engineers or to the oceanographers. It appears, at least for the time being, that the engineers have won since Ocean Engineering was included as a part of the Ship Engineering

manpower forecast rather than in the Oceanography forecast.[8] Also, at the Naval Postgraduate School the Mechanical Engineering (Ocean Mechanical option) curriculum was retained while the Oceanography Department's Technology of Ocean Operations (Ocean Engineering) curriculum was dropped. [4] Additionally, the Assistant Oceanographer for Ocean Engineering is a collateral assignment of the Deputy Chief of Naval Material (Development), which again puts the emphasis on the engineering aspects of the field.

A significant problem in the area of Ocean Engineering at the present time is the matter of definition of functions and identification of billets. The oceanography community does not presently list any billets specifically for ocean engineers; however, it is believed that several existing billets would benefit from this type of background, and they will be discussed in detail in a following section. The Ship Engineering manpower forecast listed only two billets for Ocean Engineers but qualified the listing in their definition of Ocean Engineering:

> Ocean Engineering. Requires a master's level education or above in a field involving the application of engineering principles to engineering systems in the ocean environment. The ocean engineer is oriented towards application, hardware and operational techniques including ocean structures, undersea vehicles, underwater sound, wave mechanics and life support systems. No requirements data is available due to recent establishment of this code (8260P). Requirements will be identified upon completion of current Navy wide review of billets. [8]

A possible underlying reason for the general absence of billets for ocean engineers was expressed by one of the respondents to the Ship Engineering manpower forecast questionnaire:

> One difficulty in the establishment of billets for ocean engineering, in my opinion, is the fact that many senior officers who are authorized to recommend such billets have not themselves been exposed to a significant amount of graduate oceanography. As time goes on officers who have had such exposure may be promoted to positions where they may use it in their recommendations and this way lead to an increased number of engineering billets. [8]

The reasonableness of this opinion was clearly demonstrated, and the anomalousness of the ocean engineering field most graphically illustrated, during the 8th U. S. Navy Oceanography Symposium:

> <u>Ocean Engineering is unlike Oceanography</u> (writer emphasis added), in that Ocean Engineering treats the engineering disciplines associated with the above work areas (R,D,T&E and construction or placement and maintenance of special structures, systems and equipment in the sea). Oceanography is that branch of science that deals with the physical aspects of ocean waves, currents and tides; the chemicals found in seawater; marine animal and plant life; and sea floor phenomena. [31]

Now, perhaps it was not the speaker's intention to imply that there is very little connection between oceanography disciplines - physical, chemical, biological, and geological - and engineering in the ocean. That, however, was certainly the impression gained by this reader, particularly in view of the speaker's manner of expression and his separation of the two fields.

The above speaker did, however, provide a more definitive statement than can be found elsewhere concerning the purpose and function of the field of Ocean Engineering:

> Recent emphasis on undersea operations has generated new requirements in the areas of underwater search, salvage, environmental prediction, navigation, communications and other underwater endeavors. Ocean Engineering at the Naval Ship Engineering Center is concerned specifically with the development of advanced technologies in support of Naval operations and efforts in these areas.
>
> Ocean Engineering in the Naval Ship Engineering Center is defined as that branch of engineering which is concerned with conception, development and design of equipment and systems for accomplishing work on or under the ocean's surface. Ocean Engineering does not necessarily include the classical maritime and naval pursuits, or water front civil work. Engineering efforts for research, development, testing, evaluation and construction or placement and maintenance of special structures, systems and equipment in the sea, whether bottom sitting or moored, is included in the definition of Ocean Engineering.
>
> ...The Center's responsibilities in the Ocean Engineering field range from component design to complete integrated system development, including test and evaluation in the following areas:
>
> a. Mechanical Handling and Support Systems
> b. Submersible Vehicle Structures and Mechanical Components
> c. Underwater Tools and Equipment
> d. Life Support Systems
> e. Electronic Sonar and Navigation Systems [31]

In spite of the lack of identified billets and the difficulties presently being experienced in this field, respondents comments in the Ship Engineering manpower forecast indicated significant concern for ocean engineering. This was true both in terms of growth factor as applied to ocean engineering as an existing field and, judging from the number

of specific comments, in listing ocean engineering as the most significant emerging field. [8]

Interestingly enough, the only "emerging field" which garnered more comments than ocean engineering was the field of technical management. One such comment is quoted below, in part; the full comment and additional relevant comments will be found in Appendix D.

> Significant new courses are being developed in educational institutions relevant to the technical and management problems of ocean systems. This development is due to the confluence of two new forces: the wider recognition of opportunities and problems in the ocean environment (ocean engineering with and without manned systems) and the sharpening of management tools (systems analysis, study of alternatives, decision making) as taught in engineering schools.
>
> ...Most relevant to the Navy is the rapid development of these subject offerings within schools of engineering, targeted for graduate engineering students.
>
> ...The teaching and study of technical management is by no means restricted to schools of business. The melding of technical engineering disciplines and technical management education may well be done more in schools of engineering than has been done in accounting, economics, and profit or welfare business administration. [8]

4. Research and Development

Ocean Science is defined as that "effort in research, development, and technical guidance in support of operations, to advance the knowledge of the physical/chemical/biological/geological nature of the world's oceans and their boundaries (surface and bottom)." [22] A booklet, The Ocean Science Program of the U. S. Navy, published by the Oceanographer of the Navy, presents an excellent description of the progr a,

including: history; organization and management; accomplishments; discussions by major fields; program support, in terms of facilities, instrumentation, and material; relationship to non-Navy marine interests; and future prospects. [22]

The major fields discussed in the above booklet, in addition to the normal physical, chemical, biological, and geological studies, include:

a. Acoustics

b. Geographic Areas of Special Interest (The Artic and coastal zones)

c. Special Interest Programs (e.g., North Pacific Study-NORPAX)

d. International Cooperation

The Assistant Oceanographer for Ocean Science is a collateral assignment of the Chief of Naval Research. Thus, the Ocean Science Program forms a part of the research and development programs of the Office of Naval Research (ONR). The Ocean Science and Technology group of ONR, the Ocean Science Division of the Naval Research Laboratory, and the Oceanographer of the Navy's research and development group were combined in 1967 to form the Maury Center for Ocean Science. ONR, under its contract research program, is the principle means of providing support for Navy programs in universities, non-profit institutions, and industry. [22] It is through these research and development activities that

the Navy maintains its widest technical contacts with other military, national, and international communities. This is particularly true in the field of oceanography.

The oceanography billets that include the word "research" in their billet classification (5CDR, 7 LCDR, 1 LT, 1 LTJG) are nearly all project officer or liaison type billets. In fact, many of the billets use those actual words as a part of the billet classification or title (e.g., Project Officer, Physical Oceanography). [24] There are also 30 Lieutenant Junior Grade and Ensign billets which include the research term in billet classification; however, these are watch officer billets at Naval Facilities and the specific duties of the billet are classified (See Appendix B). As discussed earlier in this study, an officer serving in a research type billet could benefit from having had both the technical and the management education. As expressed in the Ocean Science Program booklet:

> The interaction among scientists and engineers in environmental programs and in systems development, naval officers, and operations analysts must be a continuing process for each to be productively aware of the capabilities and needs of the others. The scientific program manager must be aware of operational requirements if the environmental knowledge he develops is to be useful to the naval line officer, just as the naval officer or the operations analyst must know the extent of environmental influence. [22]

It is believed that the demand for oceanographer-managers will increase in the future as cooperative programs and exchanges of information with other agencies continu

to increase. The Ocean Science publication, cited above, described Navy Ocean Science Programs which profit from, or are of benefit to, the areas listed below. [22]

a. Weather Prediction

b. Public Health and Recreation

c. Engineering

d. Mineral and Energy Resources

e. Food Resources

f. International Cooperation

g. Education

Although the area of international cooperation is the subject of a later, separate section, the following comments are considered to be particularly relevant to this discussion of research and development.

Several new billets, not included in the listings in Appendix A, have recently been established, or are planned, for senior officers as "Oceanographic Research and Development Exchange Officer" on the oceanographic staffs of foreign navies. [32] The first billet so established is with the staff of the Director, Royal Australian Navy Research Laboratory. The first U. S. Navy officer assigned to this billet recently completed a three-month orientation tour in the Naval Oceanographic Office and, although described as "carrying an up-to-date knowledge of the most recent advances in oceanographic research, as well as mapping, charting and geodesy," is <u>not</u> an oceanography specialist or subspecialist. This officer,

in addition to having served in a wide variety of billets in the Submarine Force (1120 designator), has served on the staff of the Naval War College, and he <u>does</u> have a master's degree in government. [32] To what extent these latter two items influenced his selection for this particular billet is not known; however, it can only be assumed that considerable weight was given to these non-technical qualifications.

5. <u>Emerging Fields</u>

Many "emerging fields" have been alluded to previously in this study. This brief discussion has been included primarily for the purpose of laying groundwork for later sections, particularly for the section regarding the specific management skills required by the oceanography specialist or subspecialist. It also serves to point out a wide spread concern for technical management as an area that requires consideration when planning educational patterns for officers.

The Oceanography manpower forecast comments on emerging fields included: hydrography, ASW and acoustics, Automatic Data Processing, coastal oceanography, basic environmental education for all officers, ocean resources, geomagnetism, engineering, and management. [25] The following comment, considered to be particularly applicable, is one of several that will be found in Appendix D:

> The academic community is increasing its offerings in environmental problems, marine ecology, waste disposal and ocean engineering. New courses in maritime law and international relations are also being offered. These courses

will benefit those officers and civilians concerned with problems involving ocean and harbor pollution, international treaties and obligations relating to law of the sea and the exploitation of the sea bed for Naval purposes. [25]

The Ship Engineering manpower forecast included as emerging fields: acoustics, pollution abatement, management, ocean engineering, interdisciplinary programs, marine systems, work analysis and control, high speed ships, human engineering, and operations analysis. [8] One relevant comment was quoted in the previous section on Ocean Engineering, and others will be found in Appendix D, including the following:

> In "Emerging Fields" I would include for the technically educated man, "Business Management." In the next decade technical decisions will increasingly be influenced by business, social and political factors. The engineer must have a "subspecialty" in some discipline of the "real world." "Business Management" doesn't precisely cover my thought but it's the closest single "field" I can think of. [8]

In this section concerning existing and future oceanography programs, numbers of billets for specialists and subspecialists have been listed and several types of billets have been discussed. It is now intended to consider the Navy oceanography organization in more detail, with specific emphasis on oceanography-management billets.

B. NAVY OCEANOGRAPHY ORGANIZATION

The Secretary of the Navy established the Office of the Oceanographer of the Navy in 1966, the same year that the Naval Postgraduate School first awarded Master's degrees in oceanography. Several years later oceanography became a

separate technical community with its own specialist officer corps. It is the purpose of this section of the study to investigate the oceanography community organization and to consider in detail the number, nature, and location of billets for oceanography specialists and subspecialists.

As discussed previously, the oceanography community is faced with not only the normal growing pains prevalent in new organizations, but it must suffer these growing pains in an atmosphere of declining personnel and funds and in a situation where the quality and variety of its services and the talents of its officers are not yet fully appreciated. Adding to the problem is a somewhat fragmented organizational structure with its senior officers concentrated in two large staffs [20], a mismatch between existing rank and billet structures [1], and an organization in which the Commander is the manpower sponsor for only 20 percent of the specialist and 5 percent of the subspecialist billets in his community. [1]

It is now appropriate to look at the existing oceanography organization, shown in Figure 1. This organization is made somewhat more confusing when one considers that the positions of the Assistant Oceanographers for Ocean Science, Environmental Prediction, and Ocean Engineering are collateral assignments for flag officers from other technical communities. Perhaps more revealing is a look at how the specialists and subspecialists fit into this organization. Although a s ightly

different format is used in order to accomodate and include all the specialists and subspecialist billets, it is believed that Figure 2, depicting billet location, is understandable and can easily be compared to Figure 1.

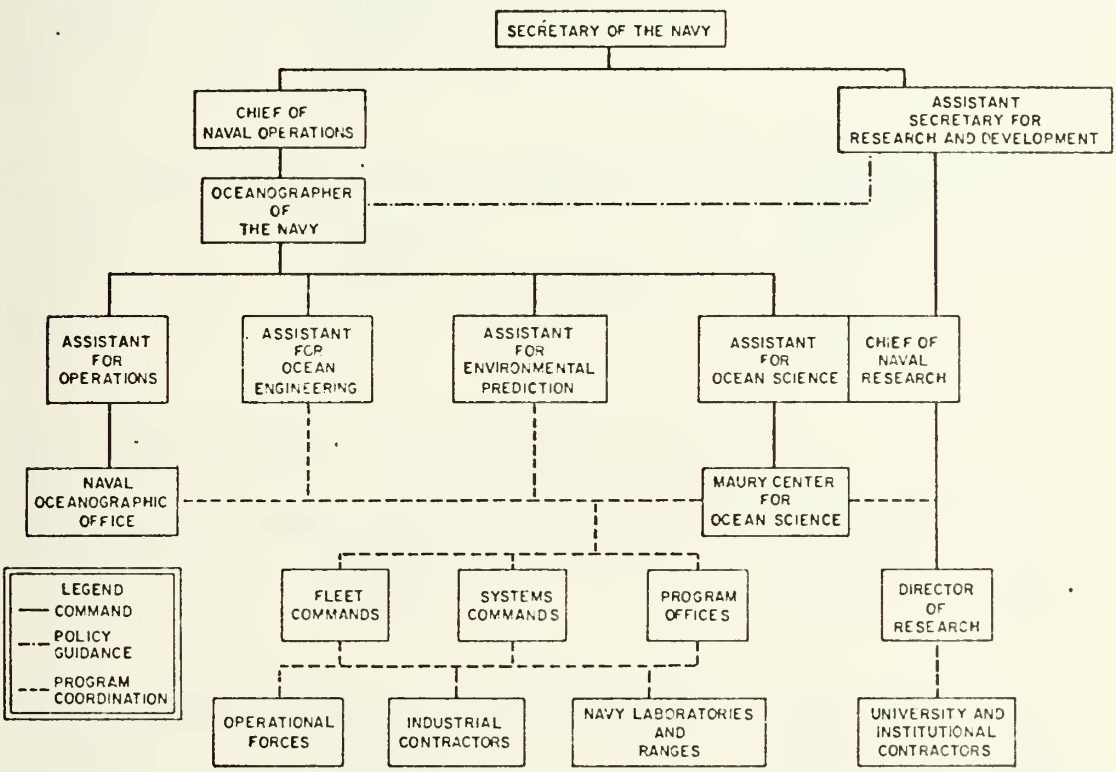

Figure 1. Oceanography Organizational Structure [22]

Not shown in the Figures, because of its recent establishment (1 July 1972), is the Defense Mapping Agency (DMA), which combines the mapping and charting functions of all the military services under one central command. Several specific billet descriptions for this new organization have been obtained however, and are included in Appendix C.

Chief of Naval Operations (OPNAV)

1820	8710P
Cdr - 1	Capt - 1
LCdr - 1	Cdr - 1

Major Commands and Staffs

1820	8710P
Capt - 1	Cdr - 2
Cdr - 4	LCdr - 8
LCdr - 2	Lt - 6
Lt - 1	
Ltjg - 1	

Office of the Oceanographer (OCEANAV)

Asst. Oceanographer for Operations

1820	8710P
Capt - 5	Capt - 1
Cdr - 2	Cdr - 2
LCdr - 1	

Naval Oceanographic Office (NAVOCEANO)

1820	8710P
Capt - 3	Capt - 1
Cdr - 5	Cdr - 1 (8720P)
LCdr - 3	
Lt - 8	

Afloat Units and Branch Offices

1820	8710P
LCdr - 7	-
Lt - 3	
Ltjg -12	

Asst Oceanographer for Ocean Engineering

- - - - - - -

Asst. Oceanographer for Env. Prediction (Naval Weather Service Command)

1820	8710P
-	LCdr - 1

Fleet Weather Centrals

1820	8710P
LCdr - 8	LCdr - 1
Lt - 4	Lt - 2

Asst. Oceanographer for Ocean Science (Office of Naval Research)

1820	8710P
Cdr - 1	Cdr - 1
LCdr - 1	

R&D Centers/ Facilities/Branch Off.

1820	8710P
Cdr - 1	Cdr - 2
LCdr - 4	LCdr - 2
	Ltjg - 1

Intelligence Facilities (Defense Intelligence Agency)

1820	8710P
Capt - 1	-
Cdr - 1	
Lt - 2	
Ltjg -26	
Ens - 4	

Educational/Training Facilities*

1820	8710P
Cdr - 6	LCdr - 6
LCdr - 7	Lt - 5
Lt - 7	
Ens - 1	

*Includes 9 student billets

Figure 2. Locations of Oceanography Specialist and Subspecialist Billets [20]

It is pointed out that, with the exceptions of the OCEANAV and NAVOCEANO staffs, the vast majority of these billets are "one-man" billets - that is, the officer serving in the billet is the only individual in that unit with advanced education in oceanography and he is the sole representative of the Oceanographer of the Navy. With the type of structure shown in Figures 1 and 2 and this "one-man" nature of most of the billets, effective liaison and coordination between the various groups is essential and requires a good understanding of the interrelationships between the different major commands.

Earlier sections of this study presented the argument that the technically educated officer is often required to perform in an atmosphere, and within a chain-of-command structure, that is quite different from his previous shipboard experience. It is believed that Figures 1 and 2 support these arguments for the case of the oceanography community. The immediately preceding section, describing Navy oceanographic programs, indicated the areas in which the oceanography specialist and subspecialist are, or may become, involved and served to reinforce the argument for assigning officers with specific management skills to many of the billets. The next section will address all the specialists and subspecialists billets with regard to rank, designator/P-code, billet description (if available), and the requirement for particular management expertise.

It must be recognized that the oceanography community is still going through a period of rapid development and change, and the billet structure is subject to continual rearrangement. The numbers and types of billets discussed in the following sections were those in existence as of 31 March 1972; however, known changes, such as the additional billets required upon the establishment of DMA, will be indicated. In this regard, it is known that DMA includes at least one Captain billet and three Commander billets for 1820 officers. These billets are not listed in Appendix A; however, two specific billet descriptions were obtained and are included in Appendix C. In support of the argument for a higher degree of management skills in senior billets, the DMA 1820 Captain billet, "Chief, Hydrographic Division, Programs, Production and Operations Directorate," includes under "Mandatory Qualifications":

(1) 1820 designator or 1100 (Subspecialty 8710P)

(2) Degree in one of the physical sciences or in management or a minimum of 12 years experience in staff management of large production programs.

(See Appendix C for full billet description)

1. Specialist (1820 designator) Billets

As outlined in the "Definitions" section, the specialist is an officer who pursues his career solely in areas related to oceanography. The qualifications for selection as a specialist do not require postgraduate education.

However, if such education has been completed, which is the case for most existing 1820 officers in the grades of Lieutenant through Commander, the officer is assigned a P-code, either 8710P (Oceanography) or 8720P (Hydrography). The same logic is applied to coding of billets; whereas most specialist billets also carry the additional requirement for the 8710P code, some few do not. The following discussion will make no distinction between these two categories of billets and the comments with regard to the degree of management expertise required will apply in either case.

a. Numbers and Types of Management Oriented Billets

Figure 3, below, displays existing specialist billets and indicates the number of these billets that are considered to be primarily management, administrative, or liaison in nature.

It should be noted, perhaps understandably, that the management oriented billets are almost exclusively in the upper ranks - from the mid-Lieutenant Commander level on up. These are the billets that will primarily be addressed with regard to the need for particular management skills.

The remainder of the Lieutenant Commander, Commander, and Captain management billets are with major commands and staffs or are research-liaison officer billets. Appendix A lists all the specialist billets by rank, location, title, classification, and general function.

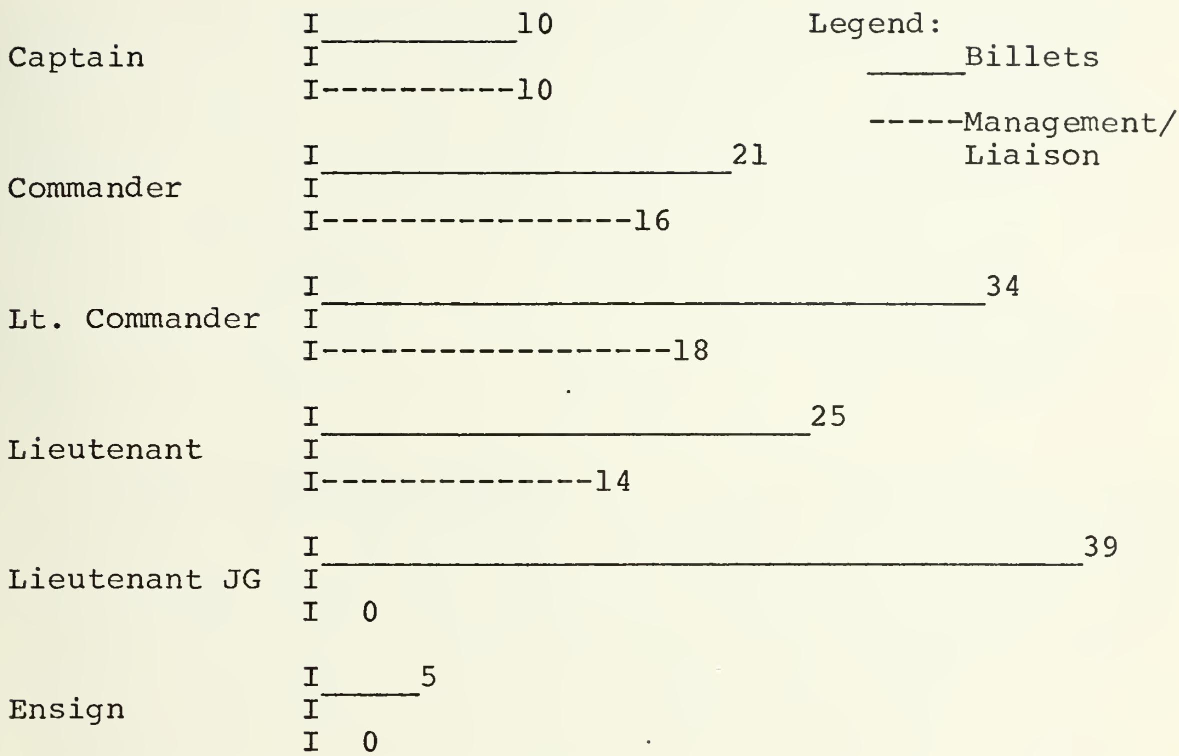

Figure 3. Management Oriented Specialist Billets

A substantial number of management billets are, of course, on the OCEANAV and NAVOCEANO staffs:

Table V. Specialist Billets on OCEANAV/NAVOCEANO Staffs [20]

	CAPT	CDR	LCDR	LT
OCEANAV	5	2	1	-
NAVOCEANO	3	5	3	8
Total	8	7	4	8

The Naval Officer Billet Classification (NOBC) codes, which are listed and defined in Appendix B, are general descriptions and may be applicable to a number of different billets and for different ranks. For the management oriented

billets, the classifications that appear most frequently are Hydrographic Programs Officer (NOBC 2310), Oceanographic Programs Officer (NOBC 2320), and Naval Oceanographer (NOBC 2340). These three classifications apply to a total of 28 billets: ten Captain, ten Commander, five Lieutenant Commander, and three Lieutenant. The latter classification, Naval Oceanographer, is provided below:

> 2340-Naval Oceanographer. Provides oceanographic, hydrographic, air/ocean interface and air navigational information for the Navy: Administers all phases of naval oceanography and hydrography including field surveys; adjusts programs to conform to budget; authorizes exchange of hydrographic and oceanographic information with foreign governments within limits of existing documentation; maintains liaison with governmental and non-governmental organizations concerned with oceanographic matters; participates in oceanographic projects as the Navy representative. [33]

This billet classification, which applys to seven Captain, three Commander, and two Lieutenant Commander billets, again points out the diverse areas in which the oceanography specialist should be knowledgeable.

b. Examples of Specific Billets

The intent of this section is to provide the reader with a more complete picture of the actual, stated requirements of several billets, utilizing billet classification, actual billet title, and specific billet description. Although a complete analyzation of all specialist billets, using the above criteria, might be desirable, such an approach is not considered to be particularly feasible at this point due to the length of many of the specific billet descriptions. It is believed that discussions of two

billets will serve to illustrate the requirements for particular management skills. In any event, all the specific billet descriptions obtained have been included in Appendix C. It should be recognized that specific billet descriptions are not always available, and the descriptions included in Appendix C were, in general, written in response to the Navy wide review of subspecialty (P-coded) billets. [10]

The two billets to be described here will be a Captain billet and a Lieutenant Commander Billet. The Captain billet is the Assistant Chief of Staff for Plans, Operations and Readiness in the Office of the Oceanographer of the Navy. This billet carries the 2340 NOBC, described above, and the oceanography P-code (8710P) requirement. The detailed billet description is as follows:

(1) Acts as the central point of contact and principal liaison officer for Naval Oceanographic Program matters including RDT&E and Navy support to the DOD and the National Program.

(2) Coordinates and appraises all Naval Oceanographic Program efforts.

(3) Advises the Oceanographer on the initiation, development, and management of oceanographic programs to ensure the timely acquisition of necessary oceanographic, hydrographic, navigational, and geodetic information and support for dissemination as required by appropriate authority or by applicable statute.

(4) Provides technical advice as needed by other staff divisions, the Assistant Oceanographers of the Navy, and OPNAV divisions in....

(5) With the Director, Navy Laboratories, and other bureaus, commands, and office concerned, reviews and prepares...

(6) Monitors related Navy efforts outside the Naval Oceanographic Program, and maintains awareness of national and international programs in oceanography to ensure appropriate coordination of program components.

(7) Provides guidance for the development of budgets and allocations of resources to ensure consistency with...

The full billet description can be found in Appendix C; however, it is believed that the portion quoted above is sufficient to illustrate the complexities of this billet. With the full description will be found the specific justification for the 8710P code, which includes the statement: "is in daily contact with high level professional personnel, both military and civilian, from the government, universities, industry and private interests concerned with oceanography." (See Appendix C for full text).

The Lieutenant Commander billet to be described is a Project Officer billet on the Operations Study Group staff with the Center for Naval Analysis (CNA). It should be explained that CNA is basically a civilian analyst organization, with a civilian president, but operated under Navy contract and with a small group of naval officer operations analysts assigned to the staff. The Lieutenant Commander, 1820, billet is also P-coded and carries the 9085 NOBC, which is the classification for "Operations Analyst." The specific billet justification is as follows:

The requirement for such an officer (1820/8710P) is the need for the capability to understand the effects of the environment on the varied efforts of the Navy.

Specifically, the subspecialist is called upon to translate environmental information into a format that can be utilized by the analyst. This translation and associated analysis will greatly assist in the study of operations, exercises and tests. This asset will also insure that the planning of subsequent events will consider the environment.

In conjunction with planning, the officer will have the opportunity to assist in quantifying the spectrum of factors that affect the difference between the expected and the realized operational results. Obviously, one segment of the spectrum is composed of the environmental parameters. The qualifying of these parameters will assist in the analyses, which will mean future refinements and better results.

The past study efforts at the Center for Naval Analysis illustrate the advantage of having a subspecialist (8710) assigned. Of the first order of importance is Project BLUEWATER, which reported on the Navy's role in the exploitation of the ocean. Of equal priority are the continuing study efforts which include the analyses of operations, exercises and tests; the evaluation of weapons and sensors; and the review of research and development projects. Finally, the broad spectrum assistance that CNA provides the Divisions of the Office of the Chief of Naval Operations is often within the area of USW/ASW. This liaison requires immediate expertise, a quality inherent to the specialist. [34]

Both of the foregoing billet descriptions provide support for the arguments to equip the oceanography specialist with a set of management tools and techniques that will enhance his capabilities as a technical manager.

2. Subspecialist (8710P code) Billets

The 8710P (or 8720P for Hydrography) code identifies an officer, or a billet that requires an officer, "who has completed postgraduate education in oceanography." [1] The 8710P billets being addressed in this section are the non-1820 billets. It should be remembered that the P-code is a *sub*-speciality code, and the officer or billet to which this code is applied also has a "specialty," which may or may not be in

the oceanography field. The "specialty" fields that are represented in the oceanography subspecialists include: Surface Warfare; Antisubmarine Warfare; Submarines; Aviations; Meteorology; and Engineering Duty (1400 designator).

a. Numbers and Types of Management Oriented Billets

Figure 4, below, displays existing subspecialist billets and indicates the number of these billets that are considered to be management, administrative, or liaison in nature.

```
                  I____3
Captain           I
                  I---3                          Legend:

                  I__________9                     _____Billets
Commander         I
                  I---------9                      -----Management/
                                                        Liaison
                  I____________________18
Lt. Commander     I
                  I-------7

                  I______________13
Lieutenant        I
                  I   0

                  I_1
Lieutenant JG     I
                  I-1
```

Figure 4. Management Oriented Subspecialist Billets

The management billets for the subspecialists, while still concentrated in the upper ranks, are more the "one-man" type billets described earlier - that is, the incumbent is the sole officer with advanced oceanography education in a major staff or command. Even though the actual

billet title is usually something other than "Oceanographer," the officer should be the recognized oceanography expert on the staff. The listing of billets, provided in Appendix A, illustrates this "oneness" of the majority of the subspecialist billets and indicates that the majority of the management oriented billets are of the research-liaison type.

As could be expected, the NOBC codes listed for the subspecialist billets tend to favor the specialty, rather than the oceanography subspecialty, aspects of the particular billet and appear to emphasize Project Officer type billets as well as the research-liaison officer billets.

b. Examples of Specific Billets

Following the same format used for the specialist billets, two subspecialist billets will be discussed - a Commander billet and a Lieutenant Commander billet. Other subspecialist billets are listed in Appendix A, and additional specific billet descriptions can be found in Appendix C.

The Commander billet, "Ocean Survey Program (OSP) Manager," is in the Naval Oceanographic Office and requires a Submarine specialist (1120 designator) with the Hydrography P-code (8720P). The NOBC associated with this billet is 2310, Hydrographic Programs Officer, and the classification is defined as follows:

> <u>2310-Hydrographic Programs Officer</u>. Verifies and coordinates Navy requirements for hydrographic information under general management control of Defense Intelligence

Agency: Initiates program guidance for survey and production effort to meet requirements; directs preparation of documents required for DOD funding of hydrographic effort; provides financial management for hydrographic programs; reviews plans and operational programs for hydrographic implications; coordinates efforts with other mapping and charting agencies. [33]

The specific billet description is as follows:

OSP PROGRAM MANAGER plans, coordinates and monitors the Ocean Survey Program (OSP), establishing objectives and priorities for the accomplishment of surveys, data reduction, production and distribution of charts and related items for the program based on requirements established by the Director, Defense Intelligence Agency (DIA), Chief of Naval Operations and Fleet Commanders; develops program guidelines, provides liaison to bureaus, offices and activities of the Navy and other official and unofficial organizations as required in matters related to OSP

The Lieutenant Commander billet, selected here primarily because of the ready availability of the specific billet description, is the "Research Coordinator" at the Naval Recruiting Command Headquarters. This is a newly-established billet (July 1972) and does not appear in the listing of Appendix A. Although an NOBC code had not yet been assigned, it is expected that NOBC 9085, Operations Analyst, or NOBC 9087, Staff Plans Officer, would be applicable. (See Appendix B for descriptions of these classifications).

The specific billet description is as follows:

Responsible for plans related to oceanographic recruiting programs. Prepares correspondence concerning environmental matters and conducts analyses in the management evaluation and appraisal of recruitment programs. Must be technically and professionally qualified to address statistical analyses, trend analyses and other operations analysis techniques. Will be COMNAVCRUITCON point of contact in support of SECNAV

conservation program and Save Our Seas (SOS) program. Must be qualified to address environmental issues with contemporaries and counterparts in other environmental agencies and with industrial and academic communities.

It is emphasized that the example billets described above, for both the specialist and subspecialist discussions, although selected at random, contributed support to the arguments advanced in this study, i.e., the need for particular management skills. It is believed that wording similar to that quoted above will be found in the majority of specific billet descriptions for those billets identified as being management oriented.

C. NAVY OCEANOGRAPHY COOPERATION WITH OTHER AGENCIES

Throughout this study, many references have been made to the necessary, or desired, cooperation between the Navy and other agencies concerned with oceanographic matters, and it is believed that the need for such cooperation has been well established in this paper. The manner in which oceanography officers are educated in order to enhance their capabilities to fulfill this need is the subject of a later section. The purpose of this section is to outline the various areas in which this need exists - that is, cooperation with the other U. S. military services, Federal agencies, non-government agencies, and foreign governments.

It is not the intent of this section to investigate in detail the many and varied contacts the oceanography officer

may experience with other agencies, but rather to provide an outline, or examples, of some of the major agencies with which the Navy oceanography community is involved and the nature of the involvement. It should be remembered that this area of "cooperation" is being considered with regard to particular management skills that would benefit the oceanographer officer.

1. Military Services and the Department of Defense

One primary area of cooperation between the oceanography community, the other military services and the Department of Defense has already been mentioned briefly - cooperation with the Defense Intelligence Agency (DIA). The number of 1820 billets involved directly with intelligence activities should provide ample demonstration: Captain and Commander billets at DIA Headquarters, two Lieutenant billets as Oceanographic Analyst at other intelligence activities, and the large number of Lieutenant Junior Grade and Ensign billets at Naval Facilities. In addition, several billets on the OCEANAV and NAVOCEANO staffs involve programs based on requirements established by the Director of DIA. One of the respondents for the Oceanography manpower forecast made this comment:

> Since the early 1960's the major geodetic efforts have been of such magnitude that they have been joint service undertakings and have been administered by the Mapping and Charting Directorate of the Defense Intelligence Agency. As a result the combined talent of all three services plus the National Ocean Survey has been brought to bear on problems which have had high defense priorities...The importance of the Naval officer has been more in the activity

in the joint service/DIA arena in solving fiscal and operational problems. The majority of actual field work and analytical work for Navy has been done by civilians. [25]

This function has now been taken over by the new Defense Mapping Agency (DMA) and, although the billet structure for DMA is not yet firm, four oceanography specialist billets already exist. It has been estimated that this new Defense organization could eventually absorb as many as 50 percent of the present billets in the Naval Oceanographic Office. [35] This trend toward "Defense" agencies, such as DIA and the Defense Supply Agency (DSA), in lieu of separate service agencies is likely to continue, particularly in view of the reduction in force efforts and the limitations on the military budget. In fact, it would not appear unreasonable to expect establishment of a "Defense Weather Agency" which would combine the weather prediction and environmental forecast facilities of the U. S. Air Force Air Weather Service and the Naval Weather Service Command.

Cooperative efforts with other military services is also illustrated by programs such as the disposal of munitions and warfare chemicals in the ocean and the recovery of the unarmed H-bomb off the coast of Spain several years ago.

In each of the above instances, a knowledge of the other service organization, and its capabilities and limitations, is essential for effective day-to-day coordination.

2. Federal Agencies

Cooperation with Federal agencies has long been a part of the Navy oceanography programs, particularly in such areas as production and distribution of nautical information and providing hurricane warning services. The Naval Weather Service has recently revised its Navy Marine Climatic Atlas, a worldwide climotological reference series, and has also recently made available a series of detailed, small area climatologies covering the water areas bordering the continental United States. [36]

RADM Behrens, former Oceanographer of the Navy, listed the establishment of the National Oceanic and Atmospheric Administration (NOAA) as one of the four important factors affecting future oceanographic planning, and then stated:

> I strongly supported the formation of NOAA, and I have always believed that a new NOAA and an old Navy would advantageously cooperate in oceanography.
>
> To accomplish as much as possible in our common interests, to eliminate any redundancies between our respective programs, and to couple effectively Navy's and NOAA's ocean efforts, we are now completing our plans for a closely integrated sharing of our civil oceanography. For maximum effectiveness, we are working toward an agreement whereby the Oceanographer of the Navy will serve in NOAA as a special assistant for oceanography coordination. Similarly, an exchange of some three or four key professionals between Navy and NOAA will be undertaken. I might point out here that, for example, the Navy is right now...today...using a NOAA National Ocean Survey Ship on a partly reimbursible basis to conduct a survey of joint interest. This typifies the kind of coordination we need...with both NOAA and Navy doing important coastal charting, with Navy's major ocean area requirements rising, and with NOAA properly pursuing an expanding "SEAMAP" program.

> One of my primary goals as Oceanographer is to work as smoothly and efficiently as possible with this sister organization. [23]

It should also be noted that, upon its establishment, NOAA assumed responsibilities for the programs of the National Oceanographic Data Center and the National Oceanographic Instrumentation Center from the Navy, and for the program of the National Data Buoy Project from the Coast Guard. [37]

RADM Behrens, in discussing a second of the four important factors affecting future oceanographic planning, referred to another newly-established organization, the Environmental Protection Agency (EPA), with regard to combating environmental problems:

> The skills and facilities already at work in the Navy Oceanography Program are uniquely equipped to assist in many ways by providing much needed information to agencies like EPA. Without committing new resources, we should be able to provide valuable data concerning ocean characteristics like water motion and related movements of pollutants from area to area, as well as other characteristics regularly evaluated in our Ocean Science Program. In order to be responsive to inquiries and requests for assistance of this kind, I have established within my own office, a new staff function under the Environmental Quality Division. This new division...will function as the office through which the Oceanographer can respond to the Chief of Naval Operations, and others, who ask for our support. [23]

The oceanography officer serving in a billet that requires liaison with agencies such as NOAA and EPA must be aware of the problems faced by, and the limitations placed upon, these Federal agencies. The technical education provides the common ground for discussion, but it is the

application of particular management tools and techniques, such as knowing and appreciating the other agencies' capabilities and limitations, that helps pave the way for smooth and productive cooperation of mutual benefit.

Other examples of cooperation with Federal agencies can be found in manpower forecast comments in Appendix D.

3. Non-Governmental Agencies

Cooperation between the Navy oceanography community and non-governmental agencies is primarily in the areas of research and education and through contacts with industry. Some examples of productive cooperative programs are those between the Navy and civilian oceanographic institutions such as Woods Hole Oceanographic Institute (WHOI) in Massachusetts and Scripps Institute of Oceanography in California. For example, WHOI operates the deep-diving research submarine, ALVIN, which is owned by the Office of Naval Research. [38]

The Naval Oceanographic Office publishes and distributes a quarterly Operating Schedule for the approximately 87 oceanographic research/survey ships in the Unites States. These oceanographic ships are operated by: NOAA - 23; NAVOCEANO - 15; Navy Research Laboratory - 2; Coast Guard - 11; Scripps - 6; WHOI - 4; other academic institutions - 20; other institutions/state/private - 6. [39] A number of these ships, when not occupied in programs for their parent institutions, are made available to others for use.

Another area of cooperation is through the National Sea Grant Program, which receives funds from state, industry, and other organizations. This program helps support universities and other qualifying institutions in three areas of effort: education, research, and marine advisory services. [40] Recently a National Sea Grant Program was funded at Washington Technical Institute, Washington, D. C., for its education program in marine science technology. Its advisory committee, which provides support for the program, includes the Naval Oceanographic Office. [41]

Past cooperation with industry has taken the form of developing new equipment for ocean research in order to fulfill Navy program requirements. It is anticipated that, while continuing this cooperative development pattern, additional areas for cooperation will appear with the increased industrial interest in ocean exploitation. In the words of one of the manpower forecast questionnaire respondents, commenting on emerging fields:

> "...I would say that the most rapid growth area will be civil use of the ocean's resources. I think this will occur primarily in the mineral resources area. This will involve the making of multi-megabuck decisions based on sound knowledge of the ocean environment and ocean technologies. The Navy should stay close to these developments in order to profit by this substantial non-DOD investment." [25]

4. <u>Foreign Governments</u>

This area concerns international cooperation which, again, has been extensively discussed in this paper. Th

Naval Oceanographic Office has a continuing program designed to "help other nations gain insight into the oceanographic processes along their coasts." [42] For these studies NAVOCEANO generally provides the survey team (2-4 scientists) and equipment, and the host country supplies the ship and personnel to operate it.

It is believed that consideration of this NAVOCEANO program, references to international cooperation in previous sections of this study, and the following statement by the former Oceanographer, RADM Behrens, constitute substantial support for providing oceanography officers with management education, particularly in the areas of international relations and international law. These and other specific management skill requirements will be discussed in detail in later sections.

> Because of the Nixon Doctrine and the situations which it brings about in our international and national security relations, I am placing new emphasis on the tasks of my staff Special Deputy for International and Interagency Affairs. This is a GS-16 position, which is being strengthened in its status and responsibilities to me. The Marine Affairs staff, a particular part of my headquarters, has been placed under the Special Deputy and its contributions and responsibilities--as well as its talents--are being upgraded for the purpose of special studies and reports. I am interested in recruiting new, particularly talented people for this Marine Affairs Staff.
>
> To profit from cooperation in the significant oceanographic work being done by several of our foreign allies, I am strongly promoting an international exchange of oceanographic personnel between my staff and key NATO and SEATO countries. To date, we are negotiating with Canada (particularly because of our common Artic interests) and have made a proposal to Australia because of mutual interests in the Indian Ocean.

Also, last fall we leased an oceanographic survey ship to New Zealand (which will provide us with survey data) and we are considering other bilateral oceanographic assistance and exchanges with a few other friendly countries. With our world wide oceanography program, it is practical for the Navy to participate in international cooperative ventures without mounting new efforts unrelated to our mission requirements.

Closely related to the implications of the Nixon Doctrine are the critical on-going international negotiations concerning Law of the Sea. These of course can greatly affect naval oceanography, and yesterday I added a well-qualified lawyer to my staff in order to assist and monitor our oceanography interests as the U. S. position adjusts and crystallizes during these vital negotiations.

Also, within the next month or so, my new staff oceanographic analysis officer will report on board. He will be responsible for following international aspects in terms of the developments of other seafaring and oceanographic nations around the world, particularly the Soviet Union. [23]

IV. AREAS FOR MANAGEMENT STUDY

Throughout this study, references have been made to areas, or disciplines, described as "management." It was argued that the oceanography officer could enhance his capabilities and performance in the technical oceanography field by being exposed to some sort of formalized education in these non-technical "management" areas. A summary of the management areas mentioned thus far in this paper is provided in Table VI, below.

Table VI. Summary of Management Areas

a.	Operations Analysis	s.	International Law
b.	Systems Analysis	t.	Logistics Programs
c.	Statistical Analysis	u.	Business Administration
d.	Trend Analysis	v.	Planning, Programming, Budgeting (PPB)
e.	Work Analysis and Control	w.	Cost Estimating and Analysis
f.	Study of Alternatives	x.	Cost Effectiveness Procedures
g.	Decision Making	y.	Financial Management
h.	Feasibility Studies	z.	Resources Management
i.	Automatic Data Processing	aa.	Information Management
j.	International Policy Issues	bb.	Personnel Management
k.	International Relations	cc.	Interpersonal Relations
l.	Interagency Cooperation	dd.	Personnel Evaluation
m.	Political Objectives and Factors	ee.	Navy Civilian Policy and Practices
n.	Public Relations	ff.	Design and Administration of Training Programs
o.	Social Factors	gg.	Economics
p.	National Security		
q.	Law		
r.	Maritime Law		

It might be noted that some of the above areas of study, such as Law, International Relations, and Politics, are not exclusively a part of the management area. These subjects are,

however, at least partially within the management realm, and some degree of expertise in these areas is often required. Additionally, many of these "outside" areas are of sufficient importance that they are taught as a part of the course of study at senior service schools, such as the Naval War College, and they have, therefore, been included in this discussion.

In present usage, the word "skill" normally implies technical proficiency, such as "a skilled mechanic," and this is one of the dictionary definitions. Another definition of skill is: "Understanding, judgement; the ability to use one's knowledge effectively" [43], and this is the interpretation that is intended throughout this study.

To find any one individual who possessed an adequate degree of "skills" in all of the above listed areas would, undoubtedly, be extraordinary, but this paper does not advocate educating oceanography officers in each and every one of the areas mentioned. The argument pursued here contends that a technically educated officer who also has completed studies in a program that includes a portion of the subjects listed above will better understand, and be more adept at coping with, the different working environments found in the technical field. Although the following section will discuss some of these areas as separate subjects, the majority of the management areas will be treated as assemblages of knowledge which, when connected and applied, can result in the enhancement

of an officer's performance in the non-technical aspects of his specialty field.

It is interesting to note that a forum of Naval War College students, in commenting on development of commanding officers, listed both technical and managerial skills as strong requirements and, whereas the forum made no recommendations as to improving technical skills, made three recommendations in the managerial area. The most significant recommendation was that "all officers be provided continuing training in management concepts related to their level of responsibility."[44]

It would be extremely fortunate if an officer's duty assignments were so clear in definition that the officer could be programmed for short, concentrated courses of study applicable to the specific billet, but this is not the case, either for the technical or the management aspects of any particular billet. It is for this reason that some difficulty is experienced in attempting to list certain management skills as "requirements," while excluding others. Each subject or area studied builds, to some degree, on previous knowledge, whether obtained through experience or through earlier studies. This is the reason that officers assigned to the management curriculum at the Naval Postgraduate School begin their studies with a "core" curriculum which "provides the foundation and tools of management and leads into the electives which permit specialization in fields of interest to sponsoring bureaus or agencies." [4] The sponsoring agency of immediate concern is the Office of the Oceanographer of the Navy.

It is intended to use the fields of management specialization available to the Naval Postgraduate School as the basis for discussing skill attainment, and these fields are: personnel management, financial management, material management, management science, and economics. [4] In addition, government, humanities, and social sciences should be included in order to accomodate all the areas listed in Table VI. Several of these specialization, or skill, areas will be discussed in detail, while others, because of a lesser relevancy, will be discussed only briefly.

A. PERSONNEL MANAGEMENT/INTERPERSONAL RELATIONS

During the search for background material for this paper, it was discovered that there is apparently a much greater concern with the areas of personnel management and interpersonal relations than was previously supposed. In view of the many recent personnel policy changes instituted by the Chief of Naval Operations, such concern should, perhaps, have been expected. Nevertheless, the depth of concern expressed by such a diversity of individuals on a wide variety of occassions was surprising. It is believed that several specific examples should serve to illustrate this concern.

> There have been tremendous physical changes in the world in the last 30 years, but there have been even greater changes in the social structure, in the attitudes of our people. This change in attitudes is going to have a much greater impact on the future of our country than all the advances we have made in the physical sciences.

> Undeniably, the military as a part of the greater national society necessarily reflects the values and the attitudes of the whole, the great social forces at work in our society today are creating new problems with which the military must contend. [45]

The above statement by former Chief of Naval Operations, Admiral Arleigh A. Burke, USN (RET.), was made during a recent address on the subject of "The Art of Command" presented at the Naval War College. While changing social structures and attitudes is not a particularly new discovery, few individuals have expressed their concern in such strong terms and in comparison with advances in the physical sciences. (A most notable exception was Alvin Toffler in his book, Future Shock). Although he did not specifically state the intent to do so, Admiral Burke expounded in more detail on the subject of personnel management later in his address:

> In every organization, individuals occupying various positions have specific jobs to do. The assignment of duties may be by job description sheets, organization manuals, or by custom, but people must know who does what if the organization is to function properly. Similarly, standards must be set and quality control established for every job. There must be some yardstick of performance. The only difference between civilian organizations and military organizations is that failure in a civilian organization may mean ruin of a company or an industry, while failure in a military organization will too often result in the collapse of a nation, either immediately or more gradually. [45]

The above statement takes in all of the personnel management areas listed earlier in Table VI: interpersonal relations, personnel evaluation, civilian personnel policy and practices, and design and administration of training programs.

The fact that attainment of management skills in this area of personnel management would be beneficial to <u>any</u> naval officer should only serve to emphasize the importance and usefullness of these skills for the oceanography officer, because of the wide variety of people with whom the oceanographer must be prepared to work.

It is admitted that the average naval officer gains a significant amount of personnel management experience during his early tours of duty in operational billets. It has, however, been suggested several times in this study that the technically educated officer, and the oceanography educated officer in particular, is more likely to be assigned to a billet requiring daily contact and liaison with a much wider group of personnel, both military and civilian. To illustrate this fact the Oceanography manpower forecast, when discussing Navy civilian manpower requirements for oceanography and hydrography, listed 825 civilian positions for GS-9 and higher with at least a Master's degree or its equivalent.[25] Contrast this with the approximately 100 naval officer (8710P specialist and subspecialist) oceanography billets requiring similar educational requirements. As a further example, in the Office of the Oceanographer, over 80 percent of the personnel are civilian scientists, engineers, or administrative personnel. [45]

An officer from the Air Weather Service of the U. S. Air Force, in a treatise on "Leadership," described the problem this way:

> To believe that you will always have an organization of men who will also be good friends is to be naive. It is particularly naive in an organization such as ours, composed as it is of technically trained men who think more and question more than the average. They are infinitely more difficult to lead than their predecessors of other years who may have excelled in valor but who did not have their education or inquiring attitude. . . . As a leader, you should know the educational level of your people, how they perform, their latent talents and their aspirations. But most of all, you should know the level of their intelligence and the limits of their capabilities. [47]

The Air Weather Service is closely allied with the Navy's meteorology community which, it should be remembered, controls a number of oceanography billets in the area of environmental prediction. With regard to the meteorology community, it is interesting to note that four senior meteorology specialist billets (1 Captain, 3 Commander) do not carry the meteorology subspeciality code (8610P), but rather list the requirement for 9610P - the Personnel Management subspeciality code. [12]

The importance of this personnel management area is further illustrated by the reports of Naval War College senior and junior officer forums which were convened, at the request of the Chief of Naval Operations, to "study the problems which confront the present-day Navy, especially in the area of command appeal." [44] These reports concentrated almost entirely on the personnel aspects of the area of command

appeal, and one of the significant problems discussed by both forums was the problem of satisfaction of personnel: the senior officer forum termed it the "human factors" problems, and the junior officer forum used the description, "insufficient knowledge about handling and managing people." [44] Both forums made a similar recommendation for combating the problem by the use of applicable and relevant short courses. The junior officer recommendation, because it was more specific, is provided below:

> The problem might be stated: Does the Navy train and develop the commanding officer properly in basic managerial as well as technical specialty skills, technical specialty referring here to piloting an aircraft or conning a ship or submarine. Our conclusion is no.
>
> ...We recommend the institution of leadership training programs based on the integration of behavioral science techniques with the traditional concepts of authority, responsibility, and accountability--including also the importance of evaluation, recognition, and reward.
>
> ...We recommend that:
>
> -All junior officers be trained in all basic management skills, to include the awareness of human behavioral patterns and current socio-economic trends. This training should take place before he is placed in a managing position...
>
> -All officers be provided continuing training in management concepts relating to their level of responsibility...
>
> -A philosophy of practical development of managerial and technical skills should be emphasized at the unit commander level... [44]

It should be noted that the above recommendation is for institution of applicable training courses, implying that such courses do not presently exist. On the contrary, it is

suggested that, at least in the case of the oceanography officer, facilities are available in the management curriculum at the Naval Postgraduate School for the officer to acquire education in personnel management areas at the same time he is receiving his advanced oceanography education. This concept was referred to earlier in the discussions concerning relevant courses in technical curricula and will be discussed in more detail in a later section. It should be recognized, however, that including such courses in the oceanography curriculum would require a degree of flexibility which does not presently exist in the program. The desired flexibility may not be too far off when one considers a statement made by the Naval Postgraduate School Assistant to the Deputy Superintendent for Programs in discussing program objectives:

> Every technical program at NPS should be a 'Systems' program; i.e., one which covers a broad enough spectrum to include physical laws and human behavior as well. The breadth versus depth profile should be a function of the age and seniority of the officer coupled to his own personal motivation and desires. [48]

Facilities for acquiring education in the personnel management/interpersonal relations area are available at the Naval Postgraduate School and at other institutions. The specific courses to be studied would be determined by considering the educational and experience level of the officer, the requirements of the sponsor, and the time available for study. These aspects will be discussed in a later section.

B. FINANCIAL MANAGEMENT/COST EFFECTIVENESS

Budget restrictions have significant effects on the naval officer in nearly all aspects of his career. The effects of budget restrictions may appear as personal limitations in the form of fewer pay and allowance increases and reduced promotion or transfer opportunities. They may also appear as overall cuts in Navy funds which cause cancellation of shipbuilding programs, restrictions on operating schedules, reductions in force personnel, or cuts in oceanographic program funds. The subject of budget restrictions is introduced only in order to illustrate the variety of ways in which money problems affect the oceanography community.

One specific example for the oceanography community was provided by RADM W. J. Kotsch, Assistant Oceanographer for Environmental Prediction Services: "In providing fleet support, our greatest concern, by far, is not the financial picture but a discernible reduction in the already scarce bathythermograph reports from the fleet." [36] Although he specifically deemphasized the financial aspects, RADM Kotsch then cited such acts as destroyers being put out of commission and cuts in aircraft squadrons as reasons for the reduction of data. This example serves to point out the far-reaching effects of "budget restrictions."

A large number of the senior oceanography officers are involved in the planning of oceanography operations and n the programming of funds, resources, and personnel. These

officers require some background in the areas of financial management, cost effectiveness, and related areas. While it is true that expertise in fiscal matters is the domain of the Supply Corps officer and billets for such officers on major oceanography staffs exist, the Supply Corps officer is not educated in oceanography and will not be discussing oceanography programs with other agencies, wherein financial aspects are only one part of the total problem under consideration. It is the oceanography officer who will be required to justify initiation or continuation of particular programs. A basic understanding of fiscal practices and procedures should enhance his capabilities in evaluating and justifying the utilization of men, money, and materials.

It is believed that courses of study in financial management, properly programmed, could provide the oceanography officer with a basic working knowledge of important areas. For example, courses in procurement and contract administration, research and development contracting procedures, and cost estimating and accounting, could provide a background that would be of assistance in decision making and aid in reducing costs, in terms of both time and money, due to misdirected efforts.

C. MATERIAL MANAGEMENT AND MANAGEMENT SCIENCE

The disciplines of material management and management science are generally, in the case of the Naval Postgraduate School,

considered to be designed for the Supply Corps Officer. These two Management specialization areas do list several common courses that would, in some cases, be useful for oceanographers. Should an oceanographer be fortunate enough to be enrolled in the management curriculum, sufficient flexibility is available in the curriculum to permit the study of courses related to these specialty fields. In addition, the "core" courses in the management curriculum include several courses from each of the specialization areas.

D. ECONOMICS/POLITICAL SCIENCE

The areas of economics and political science appear to be the object of nearly as much concern as the personnel management field, and numerous examples of this concern have been provided throughout this study. These specific areas were mentioned in several of the manpower forecast comments, and more are included in Appendix D. On this same subject, the Superintendent of the Naval Postgraduate School made the following comment to the Board of Advisors in November 1971:

> At its last meeting the Board recognized the importance of exposing graduate students in the technical program to the issues raised by political and social considerations. They encouraged the School to develop programs that would allow for the introduction to appropriate courses in the existing technical programs. In response to this some 15 courses offered by the Department of Government and Humanities were reevaluated such that they now can be taken for credit by graduate students. [16]

The Superintendent then described four new courses that had been established to help meet this need:

1. The Department of State Intern Program to prepare OA students for experience tours with the State Department.

2. Seminars in International Organization Problems.

3. Science, Technology, and Public Policy.

4. International Issues in Oceanography and Environmental Sciences.

In considering the above statement and the relevant comments listed in Appendix D, one may get the impression that this concern is exclusively at the higher levels, but this is not the case. A Lieutenant Commander student at the Naval Postgraduate School made the following statement in commenting on a comparison of Naval Postgraduate School students to those in civilian institutions:

> We all must, sooner or later, leave the insulated atmosphere of the classroom and once again face the problems found in the real world of men and machines. Who are the men who will be running the machines? None other than the "civilian students" Professor Senger refers to as "more aware and sophisticated in areas such as politics and economics than are officer students." If you haven't had to face a rap session involving J. O.'s or college trained junior enlisted personnel, stand by, because chances are you will find yourself in that situation sometime during your next tour. I base this on recent experience as Admin Officer of a large combat replacement training squadron.
>
> You may not have an opportunity to become an expert in political science or economics but would not it possibly be of benefit to have some basic understanding of the principles involved? John Paul Jones had some ideas about this when he set forth his requirement that a Naval Officer must not only be a capable mariner but also a gentleman of refined manners and <u>liberal</u> education. [49]

This idea applies even more to the oceanography officer who will have to face not only "J. O.'s or college trained enlisted personnel," but also civilian scientists and engineers.

E. INTERNATIONAL RELATIONS/MARINE POLICY

The areas of international relations and marine policy, which cannot be regarded totally separate from the previous areas, are also receiving much attention and must be included when considering continuing education for oceanography officers. In fact, there are few specialty fields that would benefit more from such education than the oceanography community.

International relations and marine policy are not generally part of a management curriculum, but applicable courses are available at the Naval Postgraduate School and other institutions. The recently instituted course, International Issues in Oceanography, mentioned in the previous section, is extremely relevant to some of the problem areas faced by oceanography officers. The course description points this out:

> "GV 3901 INTERNATIONAL POLICY ISSUES PERTAINING TO OCEANOGRAPHY AND ENVIRONMENTAL SCIENCES
>
> An examination of policy choices for United States and other governments with respect to the environment, particularly the sea and atmosphere. Special attention is given to the law of the sea; options regarding the exploration, exploitation and protection of its resources and the regulation of its military/peaceful uses; meteorology with respect to its international aspects, including the 'world weather watch' and global weather manipulation; and problems arising from the exploitation, development and protection of natural resources. Relates knowledge of oceanography or environmental sciences to international policy and national security problems through the use of analytical techniques and the systems approach." [50]

This course has been completed by a small number of oceanography students, but it is not now included in the existing oceanography curriculum.

Comments listed in Appendix D also indicated a growing concern for these areas, and several academic institutions now include applicable courses in their oceanographic programs. One significant new program is "Marine Policy and Ocean Management," conducted by Woods Hole Oceanographic Institution in cooperation with MIT, Harvard, and the Fletcher School of Law and Diplomacy at Tufts University. [38] This program "is designed for cooperative investigations of marine issues by both marine and social scientists." Dr. Paul M. Fye, Director of Woods Hole, listed three reasons for the involvement with marine policy: [38]

1. Oceanographers share with many others throughout the world the strong desire to assist in improving cooperation among nations.

2. Having contributed significantly to the understanding of the ocean, we share a responsibility that this knowledge is used in the best interest of all mankind.

3. Bad policy, or the absence of policy, makes oceanographic research very difficult and sometimes impossible.

It would appear that the Navy has substantial responsibilities with regard to the first two items listed above and could be instrumental in helping to solve the problems implied by the last item.

These same areas were discussed at a Pre-Symposium meeting in May 1971, and Commander Don Walsh, who holds a PhD in oceanography, in commenting on a recommendation that the Naval Postgraduate School give greater emphasis to acoustics in oceanographic studies, stated:

> Oceanographic studies should be far broader than acoustics and should include ocean science, ocean engineering, pollution control, national and international marine affairs. Since the oceanographer will have to move into management areas with advancement, his career pattern should include enhancing billets. Such billets include a marine affairs billet in a civilian university to study the political, legal, and international aspects in this field. [51]

F. OPERATIONS ANALYSIS

The substantial number of items listed in Table VI which involve operations analysis indicate a need for oceanography officers to obtain education in this area. A trial Oceanography/Operations Analysis curriculum will be offered to a few oceanography students beginning in September 1972 [52], and it would be inappropriate to make further comments regarding this area pending an evaluation of the trial program.

Appendix F contains a proposed speech that was prepared by Commander Donald Walsh, USN. This paper covers many of the subjects discussed in the preceding sections from the viewpoint of a naval officer who holds a PhD in oceanography and who has had highly successful tours in various billets concerned with oceanography.

V. FACILITIES AVAILABLE FOR MANAGEMENT STUDIES AND THE PROGRAMMING OF OFFICERS FOR MANAGEMENT EDUCATION

There are many facilities available for educating oceanography officers in management techniques, and each facility varies with regard to length of study, subjects covered, and academic recognition received. In the case of naval officers, the time available for study is usually limited and must, therefore, be considered when discussing the various educational programs. Additionally, the following discussions will include, where appropriate, comments concerning an officer's previous experience in management related billets.

A. NAVAL POSTGRADUATE SCHOOL

The most obvious "facility" available for acquiring particular management skills through formal education is the Naval Postgraduate School (NPS). Several programs, which were presented briefly in a previous section, are available and will be discussed below.

1. Separate Educational Tour Assignments

This program refers to the career pattern wherein the officer receives his advanced oceanography education at the rank of Lieutenant and then returns several years later, as a Lieutenant Commander, for his formal management education. This would be the ideal pattern for either the specialist or the subspecialist and would permit the officer to serve a tour of duty in an oceanography billet between his technical ducation

and his management education. Such an arrangement would also provide the officer with the opportunity, during his second educational tour, to increase his general oceanography educational background or to study specific oceanography courses in preparation for his next assignment.

Completion of the formal management curriculum at the Lieutenant Commander level would provide the officer with the basic management tools and techniques which are necessary for his future billets in the technical manager/administrator area. This formal management background would be the base on which to develop the higher degree of managerial expertise required in the Commander and Captain billets.

The "core" courses of the management curriculum at NPS provide a basic background in all of the management specialization areas. It is suggested that the oceanography officer select either the personnel management or economics option for his management specialization field. Sufficient flexibility in elective courses exists so that, whichever option was selected, courses in the other option could be included within the program schedule. In this regard, relevant management curriculum course descriptions are listed in Appendix E, and several suggested programs are included.

The fact that formal management education is highly desirable (or required, in the opinion of this study), does not solve the problem of officer availability. As pointed out previously, the oceanography specialist community is

already undermanned in the Commander and Captain ranks, and some billets are temporarily filled by officers of the next lower rank. The oceanography community does not have a "pool" of officers on which to draw in order to provide flexibility in the detailing of officers. Rotations of a few officers or the establishment of new billets at the Lieutenant Commander, or higher, level result in major movements throughout the community. [53] For those reasons it is difficult for an oceanography officer to be made available for the 12 months required to complete the management curriculum.

As the oceanography community continues to grow toward its planned end strength, these availability problems should lessen substantially, assuming no large-scale exodus from the 1820 Lieutenant and Lieutenant Commander ranks. The number of officers of these ranks currently in the oceanography community should be sufficient to allow a few Lieutenant Commanders to be programmed for formal management education each year. In the meantime, other methods for management education must be explored.

2. Dual Master's Program

The Dual Master's Program provides an officer with his technical education and management education in back-to-back tours. The same management curriculum described in the previous section is utilized and the suggested programs contained in Appendix E apply. Although the problem of officer availability still exists with this program, in that the total

education time is three years, it is not quite so severe as in the Separate Educational Tour Assignment pattern. The Dual Master's program eliminates the extra transfer, to and from NPS, and the additional time required for relieving, travel, and leave, which can amount to several months of "lost" time.

The Superintendent of the Naval Postgraduate School described the Dual Master's Program as follows:

> The Naval Postgraduate School staff is developing a three year integrated engineering-management program for submission at an early date...While it is believed that such an integrated program is somewhat superior educationally to a dual program that provides for completion of the technical program prior to commencement of the management program, for officers completing their technical program in the near future the series approach is the most practical one possible. This latter approach is believed to be a most efficient method of combining the technical foundations and the management tools and techniques identified as a requirement. [54]

The primary problem with the Dual Master's Program is that it eliminates the possibility of a tour of duty in an oceanography billet between the technical education and the management education. Not having had the opportunity to observe the oceanography community at the working level, might cause the officer some difficulty in the selection of relevant management specialization options and courses. On the other hand, it is also believed that the Dual Master's Program might be preferable in specific cases. An example would be the officer who obtains his oceanography education and specialist designation at the Lieutenant Commander level and

is likely to serve his initial oceanography tour in a management/administrative billet.

3. Combined Technical/Management Program

The existing combined programs, Communications Management and Computer Systems Management, were discussed at some length in a previous section. Based on the results of these two programs, there seem to be many arguments both for and against institution of such a program for oceanography. While a combined oceanography/management curriculum is certainly not recommended for all officers studying oceanography, it is a program that should receive more than passing consideration.

The combined program, because it could be completed in two years, would appear to be a logical alternative to the Dual Master's Program for the officer who receives his oceanography education and specialist designation at the Lieutenant Commander level. It should also be considered for the 1820 officer who has an undergraduate degree in oceanography.

The primary problem with a combined curriculum is the difficulty in designing the program with the right mix of technical oceanography and non-technical management courses. However, it is believed that judicious use of the time available could result in a viable combined program for selected oceanography students. In the existing oceanography curriculum at NPS, only 35 of the more than 100 credit hours programmed are needed to meet Master's Degree requirements. [4]

The remaining hours are used for educational preparation courses and to meet sponsor and departmental requirements. While it is true that provisions must be made with regard to preparation courses, it is also true that some of the undergraduate courses, particularly in the mathematics area, would serve as preparation for both the technical and the non-technical portions of the program. In addition, laboratory courses that emphasize specific forecasting techniques could be eliminated or reduced in number. The existing oceanography curriculum includes 10 hours of laboratory courses in Meteorological Analysis and 14 hours of laboratory courses in Weather Elements, Ocean Wave, and Acoustical Forecasting. [4]

A suggested two-year oceanography/management program, based on courses presently taught at NPS, is provided in Appendix E. It should be recognized that this program would not preclude the addition or substitution of other relevant courses, such as introductory courses in hydrography, if established.

4. Systems Acquisition Management Curriculum

The recently established Systems Acquisition Management curriculum was also described in a previous section concerning existing programs at NPS. The curriculum is designed to educate officers for project management billets and, "in addition to basic 'core' courses, which provide the foundations and tools for project management, students take specialized courses dealing with the systems acquisition discipline." [4]

This program is not recommended for the majority of oceanography officers, but it should receive consideration for a few officers. An oceanography officer who had completed the Systems Acquisition Management should be better able to cope with the complexities of the several Lieutenant Commander project officer billets that presently exist in the oceanography community. It is believed that the systems acquisition education and the project officer experience would provide a degree of expertise that would be an asset at any one of the several Commander or Captain planning and programming billets at OCEANAV and NAVOCEANO.

The Systems Acquisition Management Curriculum outline is provided in Appendix E for information.

5. Continuing Education Program

The Board of Advisors to the Naval Postgraduate School, at its third meeting (1967), recommended that the School develop a program of continuing education, and several programs have since been proposed. The basic proposal is a program "whereby middle-grade officers who have completed their technical graduate education as junior officers can spend about 12 weeks being brought up-to-date on modern science and technology, technical management, and the latest developments in their academic specialty." [13]

A continuing education program of this nature, because of its relatively short length, could be used to advantage by the oceanography community. It appears that such a program

might be particularly useful to the Lieutenant Commander specialist, or subspecialist, who is about to serve in his first planning or programming billet, but who cannot be made available for a full management curriculum. This program could provide some officers with the very basic management tools and techniques until a sufficient number of oceanography officers can be scheduled for the full management curriculum.

The Continuing Education Program, however, does have some significant problems. Although the program was accepted in principle by the Bureau of Naval Personnel in 1970, implementation has been delayed because of general budgetary restrictions. [16] "The program has been accepted in principle and endorsed by most, but not all of the interested commands." [55] It should be noted that the Oceanographer of the Navy was one of the Commanders who did not endorse the Continuing Education Program. The reasons cited by the Oceanographer for not supporting this program were: the difficulties in tailoring the technical up-dating courses; the shortage of funds to support travel; and the availability of a defense sponsored management course providing, essentially, the same background. [56]

The defense sponsored course referred to is the Defense Management Systems Course, which is the subject of the following section.

B. DEFENSE MANAGEMENT SYSTEMS COURSE

The purpose and objective of the Defense Management Systems Course were quoted in the earlier section concerning existing programs. Rather than repeat the catalogue description of the course here, the Oceanographer of the Navy's explanation of the course is provided below:

> The mission of this school is to provide an educational program in effective program/project management for selected military and civilian persons...The curricula of this school relates to the areas of management in which officers in the grade of commander and above may be required to perform while serving in either Special Duty Officer or P-coded billets. This school, readily available to the Washington area, provides a less expensive and effective means of educating selected officers in the latest technological management techniques. [56]

The endorsement of the Defense Management Systems Course is encouraging, in that it indicated recognition of the need for a higher degree of management expertise for senior officers.

An additional advantage of the Defense Management Systems Course, not covered by the Oceanographer, is the fact that this course is available not only in the Washington area, but it is also taught at the Navy Management Systems Center, which is co-located with the Naval Postgraduate School. The two locations, the short length (4 weeks), and the frequent starting dates (8 times a year) make the course extremely versatile. Extensive use of the Defense Management Systems Course could provide a good interim solution to the problem of educating a large number of officers in a short time.

As a matter of interest, the American Council of Education has recently recommended to other educational institutions that three semester hours of credit be granted for completion of the Defense Management Systems Course. [57]

A copy of the course curriculum is provided in Appendix E for information.

C. OTHER PROGRAMS

Three other schools are suggested for consideration as facilities that can provide some degree of formalized management education. All three of the schools, the Naval War College, the National War College, and the Industrial College of the Armed Forces, are normally considered for officers of the rank of Commander and above. The Naval War College also has a Command and Staff ccurse, for which Lieutenant Commanders are eligible.

Each of the above programs is 10 months in length and, although there are areas of study common to all programs, each includes its own field of specialization. It is believed that any one of the three programs would be beneficial to the oceanography specialist or subspecialist; however, none of the three are recommended as replacements for the basic management education available through a formal management curriculum. These three "colleges" should be thought of, rather, as a higher step in the continuing educational development of an officer.

The objective and outline of instruction for each of the three programs will be presented in the following sections, and applicable comments will be included.

1. Industrial College of the Armed Forces

Based on the material covered, it appears that the Industrial College of the Armed Forces would be, for an oceanography specialist, the best of the three programs. It is noteworthy that the oceanography community has obtained one quota for an 1820 Commander at the Industrial College, and two more Commander quotas are programmed to begin in the next few years. [20] This is a good initial step in meeting the higher level management expertise requirements of the senior officer billets. The program objective and areas of study are provided below.

Objective: To prepare selected military officers for important command, staff, and policy-making positions in the national and international security structure.

Areas of Instruction:
a. United States position today
b. Comparative political thought and government
c. Review of economics
d. National security policies, programs, and budgets
e. Resources
f. Material Management
g. Economic stabilization
h. Contemporary international politics in the world economy
i. Economic capability for international conflict
j. International field studies
k. Plans and readiness
l. Science and security
m. Civil Defense
n. Public opinion and morale
o. Legal and legislative problems
p. Public speaking

[58]

2. Naval War College

As can be noted below, the Naval War College course includes several areas of study that would benefit the oceanography specialist. One 1820 Lieutenant Commander quota in this program is scheduled for 1973. [20] However, because of its heavier emphasis on war-gaming and strategy, it is believed that the Naval War College would be more suited for the oceanography subspecialist.

> Objective: To train officers in the fundamentals of warfare, international relations, and interservice operations to prepare them for higher command.
>
> Areas of Instruction
> a. Sea power and national strategy
> b. International law
> c. International relations
> d. Soviet Union and Red China
> e. United States
> f. Regional associations
> g. Developing areas
> h. Formulation of national strategies
> i. Counterinsurgency
> j. Strategic planning and naval warfare
> k. Management activities of the Navy Department
> l. Operational planning
>
> [58]

3. National War College

Although no quotas presently exist for oceanography specialists at the National War College, it is believed that this program may become more important for the oceanographer in the future. Increasing involvement of the Navy oceanography community in national and international cooperative programs might make this course a sound alternative for some 1820 senior officers.

Objective: To prepare selected officers of the rank of permanent Colonel and Lieutenant Colonel (Navy Captain and Commander) of the Armed Forces for important command, staff, and planning assignments.

Areas of Instruction:
a. United States interests in the world today
b. Factors of national power
c. National security policy making
d. Military strategies and capabilities
e. Defense management
f. Counterinsurgency
g. Communists states
h. Free Europe and the Western Hemisphere
i. Africa and Free Asia
j. Overseas studies - an appraisal of implementation of national security policy in strategic areas
k. Development of national security policy and plans [58]

VI. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the conclusions and recommendations of this study. Comments are directed primarily toward the oceanography specialist officers, since the majority of the oceanography billets are designated for 1820 officers.

A. CONCLUSIONS

1. The continued growth in complexity of Navy equipment and operations requires that significant numbers of naval officers receive advanced education in the various technical fields, including the field of oceanography.

2. Despite its concern with military problems, the Navy's oceanography community also has the capability and facilities to assist in the solution of national and international

environmental problems. Such assistance and cooperation with other agencies would likely result in improving the "image" of the Navy in this era of general discontent with things military.

3. Continuing budget restrictions and reductions in force personnel result in significant problems for senior oceanography officers involved in the planning, programming, and administration of the Navy's oceanography programs.

4. The trend toward establishing multiservice defense agencies, as exemplified by the recent establishment of the Defense Mapping Agency, will likely continue. The combining of separate service agencies into a centralized command structure will require greater understanding and appreciation of the other military and civilian environmental segments.

5. All of the foregoing conclusions point to a requirement for increased expertise in non-technical areas, which are collectively included under the term management. Examples of such non-technical areas are: economics; financial, personnel, and material management; international relations; operations analysis; national and international affairs; and political science.

6. In general, the early career years of an officer do not provide the type of management experience and background that is required in senior officer specialist billets. In the oceanography community the strong requirement for particular, or a higher degree of management skills appears

at about the mid-Lieutenant Commander level, and the requirement increases with rank.

7. Formal management education, although not the cure-all for budgetary, personnel, and material problems, can provide a background in management tools and techniques. Knowledgeable instructors, pre-evaluated book lists, and practical experience are some of the advantages offered by formal management education.

8. The present shortage of 1820 officers in the ranks of Commander and Captain precludes the possibility of scheduling all senior 1820 officers for a full program of formal management education. However, this problem should lessen somewhat as the oceanography community nears its planned end-strength of officers and as the presently adequate numbers of Lieutenants and Lieutenant Commanders are promoted.

9. Several interim solutions to the problem of scheduling officers for formal management education exist. Suggested programs include short, specialized management courses, combined oceanography/management curricula, and service colleges.

B. RECOMMENDATIONS

1. Officially recognize the requirement for a higher degree of management expertise for senior officers in the oceanography community, and initiate planning to provide management education at the Lieutenant Commander level.

2. Program management education, at least at the rate of 4-5 officers per year, for 1820 Lieutenants and Lieutenant Commanders who have already completed their postgraduate oceanography education and at least one tour in an 1820 billet. The 1820 billet structure presently includes five Lieutenant billets at the Naval Postgraduate School which could be used for this purpose.

3. Make use of the Dual Master's Program, at the rate of 1-2 officers per year, for those 1820 officers, Lieutenant Commander, who have not yet completed postgraduate oceanography education.

4. Establish a two-year oceanography/management curriculum option at the Naval Postgraduate School for use by 1820 officers who have an undergraduate degree in oceanography and by selected Lieutenant Commanders who desire such education.

5. Program one 1820 Lieutenant Commander per year for the Systems Acquisition Management curriculum at the Naval Postgraduate School. Following completion of the course of instruction, the officers should be assigned to one of the several Lieutenant Commander project officer billets.

6. Make extensive use of the Defense Management Systems course for 1820 Lieutenant Commanders and above. If possible, officers should be ordered to this course prior to serving in a management/administrative billet.

7. Continue plans for assignment of 1820 Commanders to the Industrial College of the Armed Forces at the rate of three officers per year.

8. Consider assignment of 1820 Captains to the National War College at the rate of one officer every two years.

9. Increase the efforts to "sell" oceanography to other segments of the Navy, military agencies, and the general public.

One final recommendation concerns Appendix F. It is recommended that the reader study this paper as it provides a good summary covering many of the areas discussed in this paper.

APPENDIX A

SPECIALIST AND SUBSPECIALIST BILLETS

Included herein are the following tables:

Table VII. SDO 1820 Officer Billets: This table is a summary of existing billets (as of 30 March 1972) for the SDO 1820 officers (Geophysics/Oceanography). Billets are coded for graduate oceanographers (8710P) and graduate hydrographers (8720P); the lack of a code indicates that graduate level education is not specified. Also included in the table is the Naval Officer Billet Classification (NOBC) code for each billet. A listing of NOBC's is found in Appendix B.

Table VIII. Non-1820 Billets P-Coded 8710 (Oceanography): This table is a summary of existing billets (as of 30 March 1972) for non-1820 Officers, P-coded 8710. One billet carries the 8720P (Hydrography) code. NOBC's are included and officer designators are indicated.

To indicate the primary oceanography discipline and the billet function, each billet listed in the tables was assigned a two-letter code from the following lists:

Oceanography Discipline	Billet Function
G - General Oceanography	R - Research
P - Environmental Prediction	M - Management/Administration
H - Hydrography	L - Liaison
A - ASW/Acoustics	T - Training and Education
E - Ocean Engineering	O - Operational
X - Other (Student, Aviator, etc.)	

Table VII. SDO 1820 Officer Billets

Activity Title	Billet Title	Subspecialty Code	NOBC	Discipline/ Function Code
CAPTAIN (10):				
Office of Oceanographer	Chief of Staff		2340	G-M
	Asst C/S for Admin & Training	8710P	2340	G-M
	Asst C/S for Plans, Ops, & Readiness	8710P	2340	G-M
	Asst C/S for RDT&E	8710P	2340	G-M
	Military Asst to Special Deputy	8710P	2320	G-L
Naval Oceanographic Office	Commander	8710P	2340	G-M
	Deputy Commander for Production	8710P	2340	H-M
	Deputy Commander for Survey	8710P	2340	H-M
CINPAC Headquarters	Chief 51/01	-	2310	H-M
Defense Intelligence Agency	Chief 36DBA/001	8720P	2310	H-M
COMMANDER (21):				
Office of Oceanographer	Plans	8710P	2320	G-M
	Asst C/S for Financial Mgmt	8720P	2320	X-M
Naval Oceanographic Office	Director Budget Division	-	1025	X-M
	Science and Engineering	8710P	2190	E-L
	Director Operations Office	8710P	2320	H-M
	Director Plans & Programming	8710P	2320	G-M
	Asst Deputy Cmdr for Production	8720P	2340	H-M
Office of CNO, OPNAV	Asst for Deployable Systems	8710P	9038	G-L
Office of Naval Research	Special Asst for Ocean Science	8710P	2175	G-L
Naval Research Branch Office, Boston	Ocean Research/Survey	8710P	2340	H-L
Naval Postgraduate School	Instructor (2)	8710P	3255	G-T
Naval War College, Newport	Supervisor of Marine Sciences	8710P	3265	G-M
CINCUS Strike Command	Hydrographic Plans	-	2310	H-L

Activity Title	Billet Title	Subspecialty Code	NOBC	Discipline/ Function Code
CINCPAC Headquarters	Hydrographic Programs Officer	-	2310	H-L
Defense Intelligence Agency	Hydrographic Plans/Programs Off.	8720P	2310	H-L
COMUSNAVSO/COMFIFTEEN	Oceanographer	-	2340	G-L
Headquarters U. S. EUCOM	Hydrographer	-	2360	H-L
Industrial College of the Armed Forces	Student (3)	-	3289	X-T
LIEUTENANT COMMANDER (34)				
Office of Oceanographer	Environmental Quality Plans	8710P	2320	G-M
Naval Oceanographic Office	Engineering Department	8710P	2180	E-M
	Deputy Director Ops Office	8710P	2320	H-M
	Ship Maintenance Representative	8710P	5996	E-M
Operations Study Group	Project Officer	8710P	9085	G-L
Navy Research Laboratory	Acoustics R&D	8710P	2175	A-R
Office of Naval Research	Project Officer Physical Oceanography	8710P	2190	G-L
Naval Research Branch Office, London	Military Oceanography Officer	8710P	2190	G-L
Naval Postgraduate School	Asst Curricular Officer	8710P	3283	G-M
	Instructor	8710P	3255	G-T
Fleet Sonar School, Key West	Instructor - Physics of Sound	-	3255	A-T
Fleet ASW School, San Diego	Instructor	-	3270	A-T
Naval Academy, Annapolis	Oceanography Instructor (2)	-	3270	G-T
Naval War College, Newport	Student	-	3289	X-T
Naval Underwater Systems Center, New London	Ocean Survey	-	2345/ 7959	H-L
Naval Undersea R&D Center, San Diego	Asst Technical-Ocean Science	8710P	2350	G-L
C[illegible]PACFLT Headquarters	Maps/Charts/Geodesy	-	2310	H-L
COMASWFORLANT	Oceanographic/Asst Ocean Plans	8710P	2365	G-L
Navy Branch Oceanographic Office, Honolulu	Officer in Charge	-	2325	H-M

Activity Title	Billet Title	Subspecialty Code	NOBC	Discipline/ Function Code
Fleet Numerical Weather Center, Monterey	Oceanographer-Division Officer	8710P	2340	P-O
Fleet Weather Cent, Norfolk	Oceanographer-Oceano Services	8710P	2340	P-O
Norfolk	Environmental Forecaster (2)	8710P	8735	P-O
Alameda	Oceanographer	8710P	2365	G-L
Guam	Oceanography Officer	8710P	2365	G-L
Pearl	Oceanographic Services Off.	8710P	2365	G-L
Rota	Oceanographic Services Off.	8710P	2365	G-L
Oceanographic Unit	Commanding Officer (6)	-	2345	H-O
LIEUTENANT (25):				
Naval Oceanographic Office	Atlantic Operations Officer	8710P	2320	H-M
	Pacific Operations Officer	8710P	2320	H-M
	TAGOR Survey Coordinator (3)	8710P	2345	H-M
	TAGS Survey Coordinator (3)	8710P	2330	H-M
Postgraduate Schools	Student (5)	-	3289	X-T
Navy Field Operational Intelligence Off., Ft. Meade	Oceanography Operations Analyst	7210S	9640	G-L
Technical Intelligence Centers	Oceanographic Analyst	-	9660	G-L
Oceanographic Systems, Pacific	Plans	-	9087/ 2365	G-M
FASOTRAGRUPAC, Moffett	Oceanographer	8710P	2320/ 3251	G-T
FASOTRAGRULANT, PAXR	Oceanographer	8710P	3250/ 2365	G-T
Navy Branch Oceanographic Offices:				
Rodman, C. Z.	Officer in Charge	-	2325	H-M
Norfolk	Officer in Charge	-	2325	H-M
Saigon	Officer in Charge	-	2325	H-M

Activity Title	Billet Title	Subspecialty Code	NOBC	Discipline/ Function Code
Fleet Numerical Weather Center, Monterey	Meteorological R&D - Div. Off.	8710P	8718	P-R
Fleet Weather Center, Guam:	ASW Services Officer	8710P	8720	P-O
Pearl:	Environmental Forecaster	8710P	8735	P-O
Rota:	Environmental Forecaster	8710P	8735	P-O
LIEUTENANT JUNIOR GRADE (39):				
Naval Advisory Group, USMACV	Oceanographer	-	2330	H-O
Naval Facility, Bermuda	Oceanographic Research	-	2342	X-O
Bermuda	Research Watch Officer	-	2343	X-O
Pacific Beach	Oceanographic Research-Watch Off.	-	2342	X-O
Centerville Beach	Oceanographic Research	-	2342	X-O
Centerville Beach	Alt EC Watch Officer (3)	-	2343	X-O
Coos Head	Oceanographic Research-Watch Off.	-	2342	X-O
Point Sur	Oceanographic Research-Watch Off.	-	2342	X-O
San Nicholas Island	Oceanographic Research-Watch Off.	-	2342	X-O
Barbers Point	Oceanographic Research-Watch Off.	-	2342	X-O
Guam	Oceanographic Research-Watch Off.(4)	-	2342	X-O
Midway	Oceanographic Research-Watch Off.	-	2342	X-O
Adak	Oceanographic Research-Watch Off.	-	2342	X-O
Cape Hatteras	Research Watch Officer	-	2343	X-O
Nantucket	Research Watch Officer	-	2343	X-O
Ramey AFB	Operations Watch Officer	-	2343	X-O
Antigua, TWI	Oceanographic Research-Watch Off(2)	-	2343	X-O
Lewes	Research Watch Officer	-	2343	X-O
Argentia	Operations Watch Officer	-	2343	X-O
Eleuthera, TWI	Operations Watch Officer	-	2343	X-O
Keflavik	Research Watch Officer	-	2343	X-O
Oceanographic Unit	Executive Officer (4)	-	2615	H-O
	Boat Officer (8)	-	9302	H-O

Activity Title	Billet Title	Subspecialty Code	NOBC	Discipline/ Function Code
ENSIGN (5):				
Naval Facility, Bermuda	Research Watch Officer	-	2343	X-O
Barbados, TWI	Oceanographic Research Watch Off.	-	2343	X-O
Argentia	Operations Watch Officer	-	2343	X-O
Guam	Watch Officer	-	2343	X-O
FASOTRAGRULANT, QOU	Oceanographic Officer	8710P	3250/ 2365	G-T

Note: Total 1820 Billets: 134 — 1820 Billets, less LTJG and Ens: 90
Management Billets: 34 — Management Billets: 34
Liaison Billets: 23 — Liaison Billets: 23

Table VIII. Non-1820 Billets P-coded 8710 (Oceanography)

Activity Title	Billet Title	Designator	NOBC	Discipline/ Function Code
CAPTAIN (3):				
Office of Oceanographer	Air/ASW Programs	1300	2320	A-M
Naval Oceanographic Office	Programs - Budget	1100	2320	X-M
Office of CNO, OPNAV	Director for Survey OP-954	1300	9038	G-M
COMMANDER (9):				
Office of Oceanographer	Readiness and Special Programs	1120	2320	G-M
	Asst for RDT&E	1310	2320	G-L
SACLANT ASW Research Center, La Spezia	Naval Advisor	1110	7959	A-L
Navy Undersea R&D Center, San Diego	Technical Officer	1120	2175	G-L
COMAWSPAC/COMFAIR MOFFETT	ASW Training	1320	9076	A-L
COMASWFORPAC	Environmental Officer	1810	2365	G-L
Office of CNO, OPNAV	Plans OP-321	1120	9087	G-M
Office of Naval Research	Project Officer-Artic	1000	2060	G-L
Naval Oceanographic Office	OSP Project Officer (8720P)	1120	2310	H-M
LIEUTENANT COMMANDER (18):				
Naval Underwater Systems Center, New London	USEARSCHGEN/AC (2)	1400	2175/ 7959	E-L
COMCRUDESPAC	ASW Training - Readiness	1110	9076	A-L
COMCRUDESLANT	Torpedo/Asst ASW	1100	6583	A-L
COMPHIBPAC	Photo-Beach Intelligence	1110	9620	G-L
COMOPTEVFOR	Asst Sonar Development	1110	5980	A-L
COMSUBDEVGRU I	Operations/Training/DSV Oper.	1120	9065/ 9322	G-O

Activity Title	Billet Title	Designator	NOBC	Discipline/ Function Code
COMNAVINSWARPAC	Training and Education Off.	1130	9293/ 6582	G-T
Helicopter Squadron 10	ASW/Oceanographer	1311	8604	A-O
VXN 8	SPPJ-BIRDSEYE	1311	8583/ 8571	X-O
Navy Weather Service Command	Head ASW Support Office	1100	8715	A-M
Fleet Weather Center, Alameda	Environmental Forecaster	1310	8720	P-O
Fleet ASW School, San Diego	Surface ASW Tactical Instructor	1110	3270	A-T
	Submarine ASW Tactical Inst.	1120	3270	A-T
LANTFLT ASW Tactical School	ASW Instructor	1110	3250	A-T
	ASW Instructor	1120	3250	A-T
	ASW Instructor (2)	1310	3250	A-T
LIEUTENANT (13):				
COMCRUDESFLOT 2	ASWEPS Officer	1110	8730	A-O
ASW Group 2	ASWEPS Officer	1110	2365	A-O
ASW Group 4	ASWEPS Officer	1110	2365	A-O
Patrol Squadron VS41	Asst ASW	1311	8604	A-O
VXN 8	SPPJ-ASWEPS	1311	8583/ 8571	X-O
Fleet Weather Center, Rota	Environmental Forecaster	1100	8735	P-O
Fleet Numerical Weather Center, Monterey	Environmental Forecaster	1310	8735	P-O
Fleet ASW School, San Diego	Surface ASW Tactical Instructor	1110	3270	A-T
Fleet Sonar School, Key West	ASW Tactical Instructor	1110	9206	A-T
LIEUTENANT JUNIOR GRADE (1):				
Undersea R&D Center, San Diego	Asst Technical - Oceanography	1120	2175	G-L

Note: Total 8710P Billets: 44 Liaison Billets: 13
Management Billets : 7

APPENDIX B

NAVAL OFFICER BILLET CLASSIFICATION (NOBC) CODES

Included herein is a compilation of all Naval Officer Billet Classification (NOBC) codes which are listed for Oceanography specialist (1820 Designator) and subspecialist (8710P/8720P codes) billets. The Chief of Naval Operations established officer billets in Manpower Authorizations and identifies the qualitative requirements of the billets by these officer classification codes. [32] For this reason, the same classification may apply to more than one billet, and specific billet descriptions must be obtained from the particular command. A partial listing of specific billet descriptions may be found in Appendix C. The number of billets carrying each classification is noted after the billet title.

<u>1025 - Budget Officer</u> (1)

Plans and administers budget of naval activity: Secures budget requirements from operating units, analyzes estimates in accordance with prescribed policies, prepares activity budget estimates and justifications, and evaluates programs in terms of requests for appropriations; establishes apportionments by projects or organization units; conducts studies incident to obligation of appropriated funds; interprets and prepares budgetary and fiscal legislation proposals; controls obligation and expenditure of funds.

<u>2060 - Physical Sciences Research Officer</u> (1)

Directs and participates in physical science research program: Initiates and conducts research programs; coo[illegible]inates support of research projects; provides advice and infor[illegible]tion

on physical sciences aspects of naval operations and planning; controls research projects conducted under contract; collaborates with other agencies in research.

2175 - Undersea Warfare Research Officer (General) (6)

Conducts and coordinates naval scientific research programs contributing to undersea warfare advancement: Maintains liaison with Naval Establishment and other agencies to coordinate and direct pro-submarine and antisubmarine phases of undersea warfare program in accordance with established policy; promotes basic research in such fields as applied physics, meteorology, electronics, machinery design, and noise reduction as applied to undersea warfare equipment and techniques; examines new data resulting from basic research to determine use in undersea warfare programs.

2180 - Preoperational Test and Evaluation Officer (1)

Directs or participates in test and evaluation of experimental naval combat systems, equipment, and studies leading to improved design and utilization of such systems and equipment: Provides consulting services to scientific research personnel with primary emphasis on operating practices and conditions; correlates operational requirements with available or developmental equipment and makes appropriate recommendations; maintains liaison with governmental and private agencies engaged in combat systems and equipment development and evaluation.

2190 - Liaison Officer, Naval Research and Development (3)

Maintains liaison between the Department of the Navy and other governmental and private scientific activities: Maintains staff cognizance of scientific work, planning objectives and operational requirements of Navy's research and program; recommends adoption of plans or changes thereto, correlating research programs with needs of Navy; advises director and staff personnel on status of research projects; studies results of research, suggesting additional naval applications; serves, in conjunction with civilian scientists, on scientific and technical boards.

2310 - Hydrographic Programs Officer (7)

Verifies and coordinates Navy Requirements for hydrographic information under general management control of Defense Intelligence Agency: Initiates program guidance for survey and production effort to meet requirements; directs preparation of documents required for DOD funding of hydrographic effort; provides financial management for hydrographic programs; reviews plans and operational programs for hydrographic implications; coordinates efforts with other mapping and charting agencies.

2320 - Oceanographic Programs Officer (14)

Verifies and coordinates established requirements for oceanographic information: Initiates program guidance for performing activities; provides financial management for oceanographic programs; coordinates preparation of operating schedules for hydrographic and oceanographic survey vessels; prepares and maintains peacetime and wartime plans; maintains liaison with other military services and civilian agencies.

2325 - Oceanographic Mapping, Charting, and Publications Distribution Officer (4)

Directs distribution and maintenance of oceanographic, hydrographic, and aeronautical charts, maps, publications, and periodicals: Supervises personnel in making corrections to charts and publications to date of issue; monitors inventory control procedures; maintains distribution lists; acts as distributor and sales agent for all oceanographic materials.

2330 - Hydrographic Survey Officer (4)

Plans, directs, and participates in hydrographic survey operations: Utilizes knowledge and appreciation of astronomic and geodetic operations required to establish precise geodetic operations required to establish precise geodetic positions and azimuths; monitors required computations through first-order accuracy; establishes local control for hydrographic and photogrammetric surveys; conducts sounding operations; computes and predicts tidal data; serves as head of hydrographic department on board hydrographic survey vessels; supervises production of field charts and related products.

2340 - Naval Oceanographer (12)

Provides oceanographic, hydrographic, air/ocean interface and air navigational information for the Navy: Administers all phases of naval oceanography and hydrography including field surveys; adjusts programs to conform to budget, authorizes exchange of hydrographic and oceanographic information with foreign governments within limits of existing documentation; maintains liaison with governmental and non-governmental organizations concerned with oceanographic matters; participates in oceanographic projects as the Navy representative.

2342 - Oceanographic Research Operations Officer (13)

Directs activities of operations department/division: Reviews evaluation of research data; disseminates information or assists with these duties. (Specific duties classified)

2343 - Oceanographic Research Operations Watch Officer (17)

Conducts and/or evaluates oceanographic research: Supervises data collection, tabulation and analysis; acts as research watch officer; disseminates information. (Specific duties classified)

2345 - Oceanographic Survey Officer (10)

Directs or participates in oceanographic surveys: Plans and participates in oceanic exploration to collect data on configuration and nature of ocean beds, tides, tidal currents, interaction of sea and atmosphere, and icebergs; supervises analyses of seabed and sea water; develops comprehensive picture of oceanic behavior; prepares and advises on charts, manuals, and reports embodying oceanographic data; serves as head of oceanographic department on board oceanographic survey vessels.

2350 - Oceanographic Technical Officer (1)

Provides technical assistance in specialty to operational commands and equipment design authorities: Participates in compilation of reports containing strategic oceanographic data for joint service usage; undertakes technical projects in connection with studies, evaluations, and plans which may be influenced by oceanographic environment; advises son design engineers on oceanographic limitations.

2360 - Staff Hydrographic Officer (1)

Advises and assists operational command, such as anti-submarine (ASW), amphibious or mine warfare command, in preparing, interpreting, and evaluating hydrographic information: Maintains track charts for ready use by operating forces; supervises preparation of special route charts and diagrams required for operational planning; charts minefields and swept channels; maintains security of hydrographic and other source material; oversees activities of reproduction room, ensuring compilation and production of hydrographic and oceanographic and related intelligence material.

2365 - Staff Oceanographic Officer (11)

Advises and assists operational command in preparing, interpreting, and evaluating oceanographic (environmental, other than hydrographic) information: Compiles reports containing strategic oceanographic data in connection with mine warfare, antisubmarine warfare (ASW), and other related subjects; prepares charts and instructions for procedures for search and rescue (SAR) missions based on oceanographic information; maintains close liaison with staff meteorologists to ensure best interpretation and dissemination of environmental information, including data provided by the Naval Weather Service.

2615 - Administrative Officer (4)

Directs administrative division or serves as executive assistant to operating head, performing combination of administrative duties, such as personnel administration, organization and methods, space planning, work-progress reporting, and supervision of postal activities: Plans modification of organization in accordance with work load; exercises management control over personnel, services, and funds; compiles administrative manuals; analyzes organizational methods to improve effectiveness; approves request for office supplies, facilities, and equipment; recommends selection of personnel referred by personnel officer.

3250 - Instructor, Technical (6)

Organizes and conducts classes, lectures, demonstrations, and seminars in a subject-matter field of primary interest to the Navy: Trains personnel to apply principles and develop skills in areas, such as weapons, machinery, supply, and electronics.

3251 - Instructor, Academic (General) (1)

Instructs or supervises instruction of naval personnel in academic subjects: Prepares lectures, outlines, assignment sheets, and book lists; conducts classroom instruction utilizing training aids; ensures adherence to course of study; recommends curriculum; constructs, administers, and corrects examinations; certifies students upon completion of course.

3255 - Instructor, Academic (Physical Science) (4)

Instructs or supervises instruction of naval personnel in academic subjects: Prepares lectures, outlines, assignment sheets, and book lists; conducts classroom instruction utilizing training aids; ensures adherence to course of study; recommends curriculum; constructs, administers, and corrects examinations; certifies students upon completion of course.

3265 - Advanced Command and Staff School Instructor (1)

Organizes courses and guides study of senior military and civilian personnel in advanced academic program: Plans and supervises individual student research and such group activities as committee studies, seminars, field trips, and discussion groups; evaluates curriculum content, recommending and supervising changes; is concerned with such areas of study as military-industrial planning and potential, national strategy and international relations, geopolitical area studies, and high-level strategic planning.

3270 - Instructor, Naval Science (6)

Organizes and conducts classes, lectures, demonstrations and seminars in naval science subjects: Instructs in such subjects as naval history, orientation, weapons, navigation, naval engineering, machinery, ship stability, naval justice, leadership, operations, strategy and tactics, and military government; prepares assignment sheets and lesson outlines; operates training aids; administers and grades examinations; certifies course work as acceptable for credit; recommends improvement to standard curriculum; acts as advisor to student groups.

3283 - School Administrator (1)

Directs or assists in administration of naval training program at schools, colleges, universities or in one or more

department thereof: Schedules and maintains instruction in accordance with prescribed standards; advises instructors regarding teaching methods; evaluates progress of students and staff, making adjustments as necessary to achieve desired objectives; exercises disciplinary and administrative control; coordinates military activities with school schedule.

3289 - Student Officer (9)

5980 - Electronics Research Administrator (1)

Directs research activities for development of electronic equipment and systems: Reviews projects to determine application to Navy needs; initiates and administers accepted projects; coordinates research efforts between material bureaus and private contractors, evaluating progress of project; advises scientific personnel on general requirements and developments completed for service use; arranges for administrative services as needed.

5996 - Staff Electronic Material Officer (1)

Assists staff commander by administering electronic material program for operational command: Prepares and promulgates to ships of command operating and maintenance instructions for electronic equipment; inspects ships to ascertain that equipment is properly maintained; assists ships in obtaining allowance of equipment; reviews latest alterations, modifications, and arrangement plans issued by systems commands; directing compliance by ships of command; coordinates local repair activities to accomodate workload for electronics repairs; advises on problems pertaining to electronic equipment.

6582/6583 - Undersea Weapons Project Officer (2)

Administers underwater project within defined boundaries of time, resources, and performance requirements: Prepares master plan, including schedules, costs, and scope of all work and resources required; initiates overall plans for production of end products, systems, and subsystems; monitors integrated logistic support requirements; monitors contract negotiations and approves proposed contractual actions required for accomplishment of project; evaluates progress; coordinates change of scope, timing, and cost with functional organizations; controls logistic support functions; approves design changes to support equipment, as appropriate.

7959 - Naval Engineering Research Project Officer (4)

Administers scientific research in naval engineering problems: Maintains liaison with civilian contractors or sections of naval research laboratory; evaluates progress of research contract; suggests solutions to problems involving future or proposed course of project; advises scientific personnel on suitability of developmental work for Navy use; represents project in committee meetings and contracts with other organizational units; studies results of research, establishing new naval applications; arranges for conduct of tests and experiments and field expeditions.

8571 - Patrol Plane Commander, Multiengine Land Plane (3)

Commands and pilots multiengine patrol plane, land-type: examines flight plan and aviation intelligence data to ascertain nature of mission, weather conditions, and codes to be used; conducts pre-flight plane and equipment inspections; operates plane under all flying conditions; reports unauthorized or unidentified aircraft or shipping; controls aircraft during attack, manuevering plane for accurate fire by gunners.

8583 - Special Project Pilot (3)

Pilots aircraft or spacecraft for developmental and experimental purposes: Participates in special projects such as guided missiles, ordnance, electronic, and space exploration projects.

8604 - Air Antisubmarine Officer (2)

Assists operations officer in antisubmarine operations and techniques: Maintains records and submits antisubmarine (A/S) reports; collects, studies, consolidates, and disseminates antisubmarine operational material and tactical information; briefs and interrogates pilots and flight crews prior to departure and on return from A/S missions; and plans and maintains antisubmarine training program.

8715 - Meteorological Officer (1)

Directs operation of weather office in supplying meteorological, oceanographic, and climatological information to naval activities and operational commands: Maintains local liaison with weather services of other agencies; supervises

preparation of meteorological and climatological records; interprets meteorological charts and diagrams; prepares prognostic charts; prepares weather forecasts, sea condition charts, surf and swell forecasts, storm and hurricane advisories; supervises operation of communications facilities used for meteorological purposes; directs maintenance and minor repair of meteorological instruments.

8718 - Meteorological Research and Development Officer (1)

Administers research and development of meteorological equipment and techniques (including numerical methods) for analyzing and forecasting weather phenomena: Coordinates technical needs of Navy weather units; initiates projects for development of new and improvement of existing meteorological instruments; evaluates data on equipment and procedures developed by other branches and services; supervises preparation of equipment design specifications.

8720 - Meteorological Watch Officer (2)

Serves as representative of senior meteorologist officer during period of watch: Prepares and supervises preparation of weather charts, climatological studies, weather forecasts, sea condition charts, surf and swell forecasts, storm and hurricane advisories for dissemination to fleet units, operational commands, support forces, and shore establishments within area of responsibility; conducts research and investigation on weather forecasting techniques; reviews recent meteorological literature to determine latest developments; supervises or conducts training programs for meteorological personnel.

8730 - Staff Meteorological Officer (1)

Advises and assists commander of operational staff in initiating policy and plans affecting the Navy's meteorological program within the commander's area of responsibility: Evaluates meteorological information in advising and assisting commander; prepares weather studies required for operational planning; prepares weather section of operation plans, indicating in detail sea and weather conditions which can be expected; participates in briefing conferences; provides guidance to shipboard meteorological officers.

8735 - Environmental Forecaster (6)

Provides environmental analyses and forecasts in support of the operating forces: Prepares required oceanographic products for dissemination to fleet units, operational commanders, support forces, and the shore establishment; provides estimates of acoustic ranges and information concerning environmental effects on undersea warfare systems; provides oceanographic forecasts to other Department of Defense agencies as requested; conducts research on and evaluation of oceanographic forecasting techniques.

9038 - Staff Special Projects Operations Officer (2)

Coordinates plans, policies, and studies for sea phases of research and development projects: Directs and administers overall shipboard operations, such as cable laying, navigation, and salvage; coordinates underwater sound detection projects; informs staff concerning status of projects and allied research; requisitions special equipment and ensures proper operating conditions; maintains liaison with Navy units, systems commands, and other services, and civilian contractors.

9065 - Staff Operations and Plans Officer (1)

Assists commander by coordinating and directing employment of ships and units of command: Overseas preparation and implementation of training schedules and exercises; prepares standard instructions concerning disposition and tactical procedures for units constituting command's forces; directs preparation of estimates of situation, coordinating with other staff divisions; supervises staff preparations for all operation and coordination of operation plans and orders; directs critiques on results of exercises or engagements; maintains liaison with other commands and staffs.

9076 - Readiness Officer (2)

Administers program designed to maintain and improve combat readiness of ships of command: Determines efficiency rating of ships by planning, organizing, conducting, or evaluating competitions and exercises, and assigns annual and special marks; establishes test programs for equipment and/or ordnance systems; recommends modification or development of new tactics and doctrine.

9085 - Operations Analyst (1)

Conducts theoretical, statistical, and simulator analyses of complex systems: Assists in determining basis for decisions regarding selection, employment, and control of operations systems; intreprets results of fundamental operations research studies; assists in design of fleet and operational evaluations of new equipment; weapons systems, and tactics, and in interpretation of results of evaluations; assists in design, analysis, and interpretation of results of fleet exercises.

9087 - Staff Plans Officer (2)

Assists commander by coordinating formulation and preparation of plans, policies, and studies: Coordinates and directs staff preparation of all emergency, mobilization, logistic, and war plans; analyzes and evaluates such plans of higher authority, commenting on their effects upon command and preparing supporting plans as required; reviews, evaluates, coordinates, and directs such planning of subordinate commands; as required, represents commander in collaboration with other services and Government agencies in developing plans; maintains liaison with other commands and Government agencies.

9206 - Antisubmarine Weapons Officer (4)

Directs employment, operations, and maintenance of all antisubmarine (A/S) equipment under weapons department: Conducts underwater A/S search and attack; directs operation, care, and maintenance of all A/S equipment, including search and attack sonar, fire control equipment, weapons, assorted ordnance, attack aids, torpedo countermeasures, and underwater communications equipment used in identification and classification of submarines.

9293 - Underwater Demolition Team Officer, SEAL (1)

Conducts special clandestine and counterinsurgency operations.

9302 - Auxiliary Machinery Officer (8)

Administers ship's engineering division in operations and maintenance of heating and air-conditioning equipment, diesel engines, boat engines, and electrohydraulic and other auxiliary machinery: Establishes and maintains standards and procedures

for operating and maintaining machinery and equipment; investigates causes of equipment malfunctions and determines method of repair of unusual or difficult cases; initiates requisitioning of repair parts and fuel for auxiliaries; supervises preparation of machinery logs and records.

9322 - Deep Submergence Vehicle Operator (1)

Operates a manned, self-propelled, noncombatant submersible: Controls vehicle operating parameters; ensures crew proficiency and vehicle readiness; assists in preparation and evaluation of operating plans; ensures adherence to prescribed safety, checkout, handling, and maintenance procedures; directs operations at vehicle home port, as required.

9620 - Geographic Area Readiness Officer (1)

Collects, evaluates, and disseminates intelligence pertaining to specific nations or areas: Collects strategic intelligence concerning war capabilities, vulnerabilities, and plans of foreign nations; evaluates reports on weapons, organization, disposition, doctrines, and programs; prepares estimates of warfare capabilities; indicates political, economic, or sociological considerations involved in naval plans and operations; participates in joint intelligence activities.

9640 - Operational Intelligence Officer (1)

Collects, processes, and disseminates intelligence of current value in naval operations: Analyzes data on factors relating to the enemy; conducts briefings of command on pertinent intelligence; develops tasks for assignment to specific units; requests reconnaissance missions, interrogations of prisoners, or intelligence support from higher authority, as required; prepares intelligence annexes to operations orders and plans, including details of geographical, sociological, political, and economic features of area; compiles intelligence reports after operations, evaluating accuracy of intelligence estimates.

9660 - Technical Intelligence Officer (1)

Supplies technical intelligence information concerning foreign naval materials and processes: Receives, processes, and ensures timely dissemination of technical and scientific intelligence in order to keep responsible naval authorities informed concerning design, characteristics, potentialities, developments, and trends of foreign naval material and related scientific and technical processes.

APPENDIX C

SPECIFIC BILLET DESCRIPTIONS

The following specific billet descriptions were obtained from various offices and, in general, were prepared in response to the Navy wide review of subspeciality billets. [16] Many offices queried either did not have or could not locate billet descriptions for their commands. The descriptions listed in this appendix, though few in number, do serve to point out the various management skills required, particularly for the more senior billets on the two major oceanography staffs - OCEANAV and NAVOCEANO. Included in the descriptions are: Billet title, rank, P-code, NOBC (See Appendix B), and specific billet description and/or the justification for designating the billet p-coded billet.

A. BILLETS AT THE OFFICE OF THE OCEANOGRAPHER (OCEANAV):

1. Assistant Chief of Staff for Plans, Operations and Readiness: 1820 Captain/8710P/NOBC-2340.

a. Acts as the central point of contact and principal liaison officer for Naval Oceanographic Program matters including RDT&E and Navy support to the DOD and the National Program.

b. Coordinates and appraises all Naval Oceanographic Program efforts.

c. Advises the Oceanographer on the initiation, development, and management of oceanographic programs to ensure the timely acquisition of necessary oceanographic, hydrographic, navigational, and geodetic information and support for dissemination as required by appropriate authority or by applicable statute.

d. Provides technical advice as needed by other staff divisions, the Assistant Oceanographers of the Navy, and OPNAV divisions in the formulation of operational requirements for oceanographic systems and equipment, including the requirements for related training aids; and assists the Director, Development Planning Division (CNO/OP-70) in oceanographic program research, development, test and evaluation planning, programming and budgeting, including preparation of appropriate documentation.

e. With the Director, Navy Laboratories, and other bureaus, commands, and offices concerned, reviews and prepares for submission to the Chief of Naval Operations recommendations regarding requirements for facilities to support the Naval Oceanographic Program within the Navy research, development, test and evaluation program.

f. Monitors related Navy efforts outside the Naval Oceanographic Program, and maintains awareness of national and international programs in oceanography to ensure appropriate coordination of program components.

g. Provides guidance for the development of budgets and allocations of resources to ensure consistency with the Naval Oceanographic Program; provides justification required for program and budget documents, reviews and hearings; reviews execution of budget plans; develops and maintains comprehensive programs documented for presentation to higher authority and Congress.

<u>Specific Justification for Subspecialty Code Requested</u>:

To manage the Navy's oceanographic program effectively, it is essential that the Director, Programs Division possess the training and experience commensurate with a designated subspecialist or special duty officer. The Director, Programs Division is in daily contact with high level professional personnel, both military and civilian, from the government, universities, industry and private interests concerned with oceanography. To meet his responsibilities satisfactorily, he must be able to address a wide range of technical subjects and provide clear, accurate guidance. The complex and technical nature of the position requires the talent of a subspecialist oceanography (8710).

2. <u>Assistant Chief of Staff for RDT&E</u>: 1820 Captain/ <u>8710P/NOBC-2340</u>

a. Develops and coordinates plans and policy documentation. Conducts special analyses and studies for the Naval Oceanographic Program.

b. Coordinates Navy presentations and positions involving naval oceanographic matters to Defense Department.

c. Maintains awareness of, and analyses of congressional affairs which may have an impact on the Naval Oceanographic Program. Provides reviews and comments on legislative matters.

d. Conducts continuous and special analyses and studies to assist in the management, evaluation, and appraisal of the Naval Oceanographic Program undertakings.

e. Develops and coordinates naval oceanographic inputs to, and acts as central point of contact for, long-range and mid-range plans, objectives, and studies.

f. Maintains liaison with DIA on plans and policy matters which involve that portion of the Naval Oceanographic Program concerning mapping, charting, and geodesy.

g. Represents the Oceanographer in defense, national, and international matters which involve oceanography, hydrography, navigation, mapping, charting, and geodesy.

h. Administers, with other divisions as appropriate, national and international agreements for exchange of appropriate Naval Oceanographic Program information.

<u>Specific Justification for Subspecialty Code Requested</u>:

For optimum performance of duty, the incumbent should possess a masters level of education in Oceanography (8710 P-coded). For understanding the ramifications involved in developing plans and policy, and for proper analyses of the oceanographic programs, a comprehensive knowledge of the technical aspects of the air-ocean environment is essential. Without this education, it is difficult to properly coordinate with the scientific community, for various reasons, and to adequately appreciate or guide their professional activities or objectives. Also in dealing with professionals in the hierarchy of defense, national, and international organizations, it is difficult to gain their confidence or properly expound issues without a postgraduate education.

3. <u>Assistant for RDT&E</u>: 1820 Commander/8710P/NOBC-not known

This billet is not presently listed in the official 1820 billet listing[20]; however, the specific billet description was obtained. The billet description is essentially identical to that for the Assistant Chief of Staff for Plans, Operations and Readiness, listed above.

4. <u>Military Assistant to the Special Deputy</u>: 1820
Captain/8710P/NOBC-2320

The billet is as a senior staff member of the Oceanographer's Office. Supervises subordinates assigned and performs the following specific functions:

a. Act as the central point of contact in the Navy Department for requirements under the Naval Oceanographic Program.

b. Develop, collect, prepare, coordinate, staff for validation, and disseminate Naval Oceanographic requirements, both operational and RDT&E.

c. Establish requirements for technical support of oceanographic operations related to surface and underwater search, rescue, recovery, and underwater salvage, emplacements and facilities.

d. Maintain an awareness of existing Naval Oceanographic Program documentation requirements for the development effort and of products necessary to fulfill operational needs.

e. Maintain liaison for Navy with DIA concerning requirements of that portion of the Naval Oceanographic Program under DIA cognizance.

f. Provide liaison and technical support for non-traditional, unconventional military effort in DOD intelligence collection and cooperative programs.

g. Review operating schedules of Naval Oceanographic Program ships for possible additional requirements fulfillment.

h. Advise on the requirements for exchange of appropriate Naval Oceanographic Program information and oceanographic data under domestic and international agreements.

i. Represent the Oceanographer, or coordinate representation if requested, in defense, national, and international matters involving requirements for oceanography, hydrography, navigation, mapping, charting, and geodesy.

j. Determine long-range requirements for military and civilian personnel and facility resources, including the Naval Reserve, with reference to the Naval Oceanographic Program.

k. Provide the development and review of education and training efforts for the Naval Oceanographic Program, including specialist and postgraduate training, and develop recommendations as required.

l. Advise concerning the organization, administration, training, and support of the Naval Reserve with reference to the Naval Oceanographic Program.

Specific Justification for Subspecialty Code Requested:

In order to successfully and intelligently perform the functions as Head of the Requirements Division and for the optimum performance of duty the incumbent filling this billet must have advanced education in the field of Oceanography. The incumbent will be required to analyze, evaluate and judge complex oceanographic requirements. To accomplish this in an efficient and optimum manner, the incumbent requires the advanced educational background that will provide the depth of knowledge.

Since the incumbent will be participating in conferences, and high level briefings, this educational level and specialized background is mandatory in order to present the many involved and complex concepts of Navy Oceanography.

5. Heads, Plans Branch: 1820 Commander/8710P/NOBC-2320

The incumbent in this position is responsible for the development of the Oceanographic Program input into all Navy planning documents; i.e., Navy Strategic Study, Long Range Guidelines, Navy Support Plan, as well as the coordination of specific plans relating to the Naval Oceanographic Program. The same responsibilities pertain to the Navy input to Joint Planning documents originating in the Joint Chiefs of Staff. This Office will prepare Navy instructions and correspondence concerning environmental matters, conduct analysis and studies to assist in the management, evaluation, and appraisal of the Naval Oceanographic Program and would serve as the single point of contact on matters relating to coordination of planning of Navy's oceanographic effort within the National Program in the Marine Sciences.

Specific Justification for Subspecialty Code Requested:

An 1820 Commander with a subspecialty in oceanography is required in this billet to insure that the oceanographic documentation contained in Navy general and specific plans is technically accurate and factual to insure that environmental factors which affect design and operational characteristics of future Navy weapon systems be considered by planners f

new operational concepts and by program managers who convert the concepts into operational systems. The incumbent must be technically and professionally qualified to address environmental data with contemporaries and counterparts in other oceanographic oriented agencies and with the industrial and academic communities.

6. Assistant for Environmental Services: 1820 Lieutenant Commander/8710P/NOBC-2320

Justification: The Assistant for Environmental Services will be responsible to the Assistant Chief of Staff for analyzing and planning the oceanographic scientific programs for required marine environmental services to meet Navy's environmental protection responsibilities. The Navy's Oceanographic Program can provide substantial services to support the Department of Defense and national environmental protection objectives. To ensure that these services are provided in a timely and effective manner requires an experienced naval officer with higher education credentials on the Oceanographer's staff to interface on a day-to-day basis with the Office of the Chief of Naval Operations and other commands involved in solving and controlling environmental problems. An additional Geophysical Specialist on the staff will insure that this staff will be capable and fully responsive for the provision of environmental support services. The Assistant for Environmental Services will provide expertise in such areas as developing an environmental data base, measuring and monitoring pollution baselines, forecasting and assessment studies, etc. Educated and knowledgeable in oceanography and the marine sciences and working with environmental protection problems, he will be able to provide the guidance and assistance needed to insure that the full potential of the Navy's Oceanographic Program in the realm of environmental services is being achieved and utilized.

B. BILLETS AT THE NAVAL OCEANOGRAPHIC OFFICE (NAVOCEANO):

1. Commander, Naval Oceanographic Office: 1820 Captain/8710P/NOBC-2340

Commands the Oceanographic Office in its mission of enhancing the combat readiness of the Navy by providing oceanographic and navigational data, performing or recommending related research, development, testing and evaluation, supporting associated programs and complying with statutory requirements.

Specific Justification for Subspecialty Code Requested:

Incumbent acts as authority within the Navy Department for hydrographic and aeronautical charting. Complete knowledge and understanding of the science of oceanography is essential. The incumbent must be able to read and understand technical and scientific literature in the entire field of oceanography in order to establish the policies and procedures for the operation and functioning of the Office. The measure of quality and degree of expertise necessary to perform the above and exploit fully the capability of the Agency can only be achieved through a minimum of a masters degree level of education.

2. Deputy Commander for Production: 1820 Captain/8710P/ NOBC-2340

Relates military requirements to the production and dissemination of oceanographic, nautical and aeronautical charts and publications; determines military value and applicability of projects in progress or being considered for the future. Conducts special studies on value and use of specific products in the fleet.

Specific Justification for Subspecialty Code Requested:

Incumbents duties require a depth of knowledge that insures a thorough understanding of the dynamics of the oceans and the navigational environment in order to evaluate effects on hydrographic data and hydrographic requirements. Incumbent must have theoretical knowledge to properly direct and be able to render correct operational decisions concerning technical requirements.

3. Deputy Commander for Surveys: 1820 Captain/8710P/ NOBC-2340

Plans, organizes, directs, coordinates and manages all bathymetric, oceanographic, geodetic and geophysical surveys. Exercises line authority over the Survey Center and Operations Office. Administers projects in hydrography, gravity, magnetism, geodesy, bathymetry and related sciences including collection, analysis, processing and dissemination of information.

Specific Justification for Subspecialty Code Requested:

The incumbent must have a thorough knowledge and understanding of oceanography in order to be able to make sound decisions in hydrography, gravity, magnetics, geodesy, bathymetry and related areas of oceanography. Such understanding requires at least a master's educational level in oceanography.

4. Deputy Commander for Planning, Programming and Budget Office: 1100 Captain/8710P/NOBC-2320

Develops, coordinates and evaluates plans and requirements for the collection, assimilation and dissemination of geophysical, navigational, hydrographic, photogrammetric and oceanographic data and related information in support of DOD requirements and Navy plans and objectives; presents and justifies Office programs and financial plans to higher authority; provides representatives to major fleet commands to assist in development of MC&G and oceanographic requirements.

Specific Justification for Subspecialty Code Requested:

Incumbent must possess considerable knowledge, both theoretical and practical, of oceanography. He must also have a keen appreciation of the requirements for oceanographic data to support the mission of the Navy and understanding of their application to naval warfare. A master's level of education in oceanography is necessary to establish this broad background.

5. Director, Operations Office: 1820 Commander/8710P/NOBC-2320

Plans, organizes, directs and coordinates assigned functions; exercises, in the name of the Commander, technical direction of ships and aircraft for the Oceanographer of the Navy; coordinates employment of assigned ships and aircraft; in collaboration with departments engaged in field activities directs the assignment of field personnel and the preparation of technical specifications for operational and R&D surveys; develops and maintains liaison with operating forces and shore (field) activities; provides advice to management authorities on matters pertaining to survey efforts.

Specific Justification for Subspecialty Code Requested:

Incumbent must have a complete understanding of NAVOCEANO research requirements including a sound theoretical knowledge of all aspects of oceanography. Required to plan ship deployments in order to fulfill research requirements of the Command. Reviews technical specifications, approves personnel assignments and is required to have a working knowledge of the techniques and equipment required for completion of a specific survey. The degree of oceanography competence required to properly manage the program demands a master's level of education in oceanography.

6. Director, Planning and Programming Office: 1820 Commander/8710P/NOBC-2320

Under the direction of the Director, Planning, Programming and Budget Office, reviews higher authority plans and develops long-range plans to accomplish the mission of the Office; acts as a central point of contact for all requirements and programs; interprets or prepares overall schedules; specifies program priorities; prepares the Continuity-of-Operations Plan, Emergency Production Plan and other office-wide plans; conducts liaison and furnishes representation and information to external activities concerned with planned programs and projects of the Office and assists in presenting and justifying Office plans and programs.

Specific Justification for Subspecialty Code Requested:

Assigned duties require a depth of knowledge that ensures a thorough understanding of various oceanographic programs and their requirements. Necessary first-hand knowledge can only be obtained by formal education at a master's level.

7. Military Assistant to Director, Science and Engineering Center: 1820 Commander/8710P/NOBC-2190

Relates the oceanographic RDT&E efforts to military requirements, provides advice concerning requirements of and developments within the operating forces of the Navy.

Specific Justification for Subspecialty Code Requested:

Incumbent advises concerning military value and applicability of NAVOCEANO RDT&E projects. Duties require familiarity with in-house technical capabilities, understanding of theoretical basis of each project, knowledge of in-house and Navy requirements, and familiarity with NATO and other military RDT&E and technical cooperation projects. To be effective, incumbent must have theoretical knowledge of physical oceanography, geological oceanography, underwater acoustics, biological oceanography and atmospheric physics. Postgraduate education in oceanography to a master's level is necessary to provide the theoretical background described above.

8. Assistant to Deputy Commander for Production: 1820 Commander/8720P/NOBC-2340

Assists the Deputy Commander by relating military requirements to the production and dissemination of

oceanographic, nautical and aeronautical charts and publications. Provides advice concerning military value and applicability of projects in progress or being considered for the future. Conducts special studies on the value and use of specific products in the fleet.

Specific Justification for Subspecialty Code Requested:

Incumbents duties require a depth of knowledge that insures a thorough understanding of the dynamics of the oceans on a navigational environment in order to evaluate effects on hydrographic data and hydrographic requirements. Incumbent must have theoretical knowledge to properly direct and be able to render correct operational decisions concerning technical requirements.

9. OSP Program Manager: 1120 Commander/8720P/NOBC-2310

Plans, coordinates and monitors the Ocean Survey Program (OSP), establishing objectives and priorities for the accomplishment of surveys, data reduction, production and distribution of charts and related items for the program based on requirements established by the Director, Defense Intelligence Agency (DIA), Chief of Naval Operations and Fleet Commanders; develops program guidelines, provides liaison to bureaus, offices and activities of the Navy and other official and unofficial organizations as required in matters related to OSP.

Specific Justification for Subspecialty Code Requested:

Duties of the incumbent include theoretical and technical evaluation of the following fields: sound propagation characteristics in the ocean, sonar characteristics and design, submarine geology (both theoretical prediction of ocean floor structure and practical application of ocean bathymetric surveys), physical oceanography and gravity and magnetic field survey and analysis. It is not possible for an officer to have firsthand knowledge and experience in all of these areas except in courses of graduate work in oceanography.

10. Military Assistant to Director, Ocean Engineering Department: 1820 Lieutenant Commander/8710P/NOBC-2180

Provides advice concerning the military value and applicability of oceanographic engineering projects in progress or planned. Advises concerning naval considerations in the integrated logistic support (repair, modification, alteration, installation and maintenance) of instrumentation systems.

Specific Justification for Subspecialty Code Requested:

Incumbent should be familiar with oceanographic survey and research platforms, oceanographic sensing requirements and equipment problems associated with operation in the deep ocean environment and should also have a theoretical knowledge of techniques and equipment developed for oceanographic applications. Such understanding requires a master's level of education (or equivalent) in oceanography.

11. Deputy Director, Operations Office: 1820 Lieutenant Commander/8710P/NOBC-2320

Plans, organizes, directs and coordinates assigned functions; exercises, in the name of the Commander, technical direction of ships and aircraft for the Oceanographer of the Navy; coordinates employment of assigned ships and aircraft; in collaboration with departments engaged in field activities directs the assignment of field personnel and the preparation of technical specifications for operational and R&D surveys; develops and maintains liaison with operating forces and shore (field) activities; provides advice to management authorities on matters pertaining to survey efforts.

Specific Justification for Subspecialty Code Requested:

Incumbent must have a complete understanding of NAVOCEANO research requirements including a sound theoretical knowledge of all aspects of oceanography. Assists in planning ship deployments in order to fulfill research requirements of the Command. Reviews technical specifications, approves personnel assignments and is required to have a working knowledge of the techniques and equipment required for completion of a specific survey. The degree of oceanography competence required to properly manage the program demands a master's level of education in oceanography.

12. Ship Maintenance and Repair Officer: 1820 Lieutenant Commander/8710P/NOBC-5996

Under the Director, Operations Office, coordinates logistics support requirements for all current and long-range hydrographic/oceanographic operations; maintains current ship data for all Navy AGS and AGOR ships; monitors AGS and AGOR class improvement plans and prepares command endorsements on proposed alterations for all AGS and AGOR class ships; coordinates equipment employment taking into account scheduled operations, equipment overhaul and transportation requirements; coordinates installation of NAVOCEANO's own equipment aboard MSTS, Navy and Contract ships involved in NAVOCEANO operations; initiates requests for land-lease as requir

for hydrographic/oceanographic operations monitors instrumentation service requests for major equipment and develops and reviews allowance list supplements to NAVSHIPS Allowance Lists for present and proposed AGS and AGOR class ships.

Specific Justification for Subspecialty Code Requested:

Duties require understanding of a wide background of oceanography and current oceanographic programs. Provides guidance in the modification and construction of oceanographic ships, and is responsible for the overall maintenance of the installed scientific equipment. Incumbent must be able to make sound determinations on types and quantities of equipment necessary to fulfill ships' missions. Basic understanding of oceanography required can be gained only through graduate studies in oceanography.

13. ATLANTIC/PACIFIC Operations Officer: (2 Billets) 1820 Lieutenant/8710P/NOBC-2320

Prepares quarterly and annual ships schedules for all surface (Navy, MSTS and Charter) ships and submarines under technical control of NAVOCEANO in the Atlantic/Pacific area; maintains plot of NAVOCEANO field deployed units; prepares frequency clearance requests for NAVAIDS, communications and special transmitting equipment used in survey operations and RDT&E projects; participates in administrative inspections aboard ships under technical control of NAVOCEANO operating in the Atlantic/Pacific; reviews all specifications for NAVOCEANO shipboard projects, including specifications for field operations; prepares and forwards cruise data cards and maintains liaison with Navy shore (field) activities in the Atlantic/Pacific area.

Specific Justification for Subspecialty Code Requested:

Incumbent must have a complete understanding of NAVOCEANO research requirements including a sound theoretical knowledge of all aspects of oceanography. Required to plan ship deployments in order to fulfill research requirements of the Command. Reviews technical specifications, approves personnel assignments and is required to have a working knowledge of the techniques and equipment required for completion of a specific survey. The degree of oceanography competence required to properly manage the program demands a master's level of education in oceanography.

14. T-AGOR Survey Coordinator: (3 Billets) 1820 Lieutenant/8710P/NOBC-2345

Provides liaison between ships company of oceanographic research vessels, NAVOCEANO scientists on board and the Operations Officer at NAVOCEANO. Provides continuity of responsibility for scientific equipment and operations.

Specific Justification for Subspecialty Code Requested:

Incumbent is a vital link between the scientific endeavor of embarked scientists and ship's company. He must have a substantial understanding of technical and theoretical oceanography in order to provide a continuity in operations between transient scientific personnel and ship's company. The degree of oceanographic competence required can only be obtained by a master's level of education.

15. T-AGS Survey Coordinator: (3 Billets) 1820 Lieutenant/8710P/NOBC-2330

Provides liaison between ships company of hydrographic survey ships, NAVOCEANO scientists on board and the Operations Officer at NAVOCEANO. Provides continuity of responsibility for scientific equipment and operations.

Specific Justification for Subspecialty Code Requested:

Incumbent serves as manager and coordinator of scientific operations at sea. Reviews technical survey specifications and must be able to advise various user labs on the adequacy of ship service. He must have a high degree of competence in ocean surveys and oceanographic technical field in order to link ships operations with scientific endeavors. The degree of oceanographic competence required can only be obtained through a master's level of education.

C. BILLETS AT OTHER LOCATIONS:

1. Project Officer, Operations Study Group (CNA): 1820 Lieutenant Commander/8710P/NOBC-9085

a. Reviews the draft Study Directive, Study Plan and study report for definition, substance, consistency and quality.

b. Provides to the CNA Study Director military advice and guidance concerning Navy policy, strategic and operational concepts.

c. Maintains continuing liaison with OP-966, the cognizant OPNAV activities, the Advisory Committee, other interested naval activities, and appropriate other Service and DOD activities in order:

(1) Ensure that study inputs provided by the Navy to the study group have maximum validity.

(2) Ensure that the Study Plan, study reports, and other official documents concerning the study receive thorough review and understanding by cognizant OPNAV activities.

(3) Ensure that comments and recommendations of cognizant OPNAV activities receive consideration by the study group, notifying OP-96 in any case of disagreement as to study inputs which cannot be resolved within the study group.

(4) Coordinate the preparation of study summaries and CNO and SECNAV forwarding endorsements.

d. In collaboration with the CNA Study Director, prepares and delivers presentations and briefings of study progress, findings and results as may be required.

e. Supervises the military and civil service personnel assigned to the study group.

f. Supervises the administrative aspects of the study with respect to Navy interests, ensuring that personnel under his supervision observe applicable security regulations and that such personnel receive thorough indoctrination into the CNA security system and are cleared of custody of all documents under CNA control prior to being detached from the study group.

g. Submits a bi-weekly report of study progress to OP-966D.

<u>Specific Billet Justification</u>:

The requirement for such an officer is the need for the capability to understand the effects of the environment on the varied efforts of the Navy.

Specifically, the subspecialist is called upon to translate environmental information into a format that can be utilized by the analyst. This translation and associated analysis will greatly assist in the study of operations, exercises and tests. This asset will also insure that the planning of subsequent events will consider the environment.

In conjunction with planning, the officer will have the opportunity to assist in quantifying the spectrum of factors that the effect the difference between the expected and the realized operational results. Obviously, one segment of the spectrum is composed of the environmental parameters. The quantifying of these parameters will assist in the analyses, which will mean future refinements and better results.

The past study efforts at the Center for Naval Analyses illustrate the advantage of having a subspecialist (8710) assigned. Of the first order of importance is Project BLUEWATER, which reported on the Navy's role in the exploitation of the ocean. Of equal priority are the continuing study efforts include the analyses of operations, exercises and tests: the evaluation of weapons and sensors; and the review of research and development projects. Finally, the broad spectrum assistance that CNA provides the Divisions of the Office of the Chief of Naval Operations is often within the area of USW/ASW. This liaison requires immediate expertise, a quality inherent to the specialist.

- -

The following three billets are new billets, established in July 1972, and do not appear in Appendix A.

1. <u>Chief, Hydrographic Division, Programs, Production and Operations Directorate, Defense Mapping Agency: 1820 Captain/8710P or 8720P</u>

<u>Duties</u>: Supervises the Hydrographic Division which directs and manages the hydrographic portion of the DOD MC&G program. Acts as the principal advisor to the Director, DMA, on DOD MC&G hydrographic program matters and statutory responsibilities. Establishes, develops and manages programs related to nautical charts, marine navigational information, fleet ballistic missile support and ocean surveys. Provides staff direction and guidance to subordinate centers and to non-DMA components utilizing DOD MC&G resources in execution of the DOD MC&G support mission.

<u>Qualifications: Mandatory</u>

a. 1820 designator or 1100 (Subspecialty 8710P).

b. Degree in one of the physical sciences or in management or a minimum of 12 years experience in staff management of large production programs.

Qualifications: Desirable

a. Previous experience at the Hydrographic Office in production or planning areas.

b. Staff experience at Department or DOD level.

c. Operational experience with fleet or with Oceanographic Unit.

d. MS Degree.

2. Naval Staff Assistant, Hydrographic Division, Defense Mapping Agency: 1820 Commander/8710P or 8720P

Duties: Reviews U&S Commands, DOD, other government, and civilian requirements for coastal and deep ocean surveys, navigational charts and related information, and products in support of special requirements, to insure all requirements are being met in a priority manner. Reviews and recommends approval and/or changes to programs designed to satisfy these requirements. Adjusts priorities and regulates workload as appropriate. Evaluates effectiveness of programs through liaison with Fleet representatives.

Qualifications: Mandatory

a. Special Duty Officer 1820, or general line officer 1100 with 8710P subspecialty.

b. Educational experience at the Master's level in one of the physical sciences.

c. Operational experience with the fleet.

Qualifications: Desirable

a. Master's Degree.

b. Operational experience particularly as navigator, and/or survey ship experience.

c. Experience in chart compilation, and production at the managerial level.

d. Previous staff duty.

3. <u>Research Coordinator, Naval Recruiting Command Headquarters:</u> 1000 Lieutenant Commander/8710P

Responsible for plans related to oceanographic recruiting programs. Prepares correspondence concerning environmental matters and conducts analyses in the management evaluation and appraisal of recruitment programs. Must be technically and professionally qualified to address statistical analyses, trend analyses and other operations analysis techniques. Will be COMNAVCRUITCOM point of contact in support of SECNAV conservation program and Save Our Seas (SOS) program. Must be qualified to address environmental issues with contemporaries and counterparts in other environmental agencies and with industrial and academic communities.

APPENDIX D

FORECASTS OF PROFESSIONAL MANPOWER REQUIREMENTS IN OCEANOGRAPHY AND SHIP ENGINEERING

These forecasts were based on a technique which employs a series of questionnaires, completed at three month intervals, with opinion feedback to inform respondents of divergent views. The questionnaires were "addressed to selected experts in specific fields to gather their opinions in a form that will be useful in projecting future requirements for officers and civilians educated at various levels and in appropriate fields of academic achievements." [25] Respondents were requested to assign change factors to specific listed fields, reflecting relative expansion or contraction of current officer and civilian manpower requirements over the next ten years. Change factors were to be assigned after considering the current manpower requirements, a set list of assumptions, and, following the initial questionnaire, the comments and opinions of other respondents. Additionally, respondents were requested to comment freely concerning their choice of change factors, new academic courses or degree fields which may be of significance to the Navy in its postgraduate curricula, and emerging occupational fields and/or requirements which may impact on future Navy professional manpower requirements. Comments relevant to this study are listed below:

(Respondents were not identified in the forecasts, and only those comments which may have been of interest to all respondents were included.)

A. OCEANOGRAPHY MANPOWER FORECAST:

1. Opinion Feedback Comments: (Total number of comments - 33

a. Respondent's Comment. "...it is clear to me that most, if not all, postgraduate curricula should include some environmental courses to include at least a basic meteorology/oceanography introduction. The Navy more than other service must operate in our total environment; sea, air and land. Courses in Political Science and International Relations should include courses in those aspects of the environment which serve to make a particular people "the way they are."

b. Respondent's Comment. "National effort in oceanography is shifting away from the deep oceans to the coastal zones - this is where the most pressing problems are. Their solution still requires the Oceanographer for the most complex part of the problem concerns the interaction of the ocean with inland waters, bays, estuaries and lagoons. This means in effect, that only two federal agencies will maintain a major effort to unravel the unknowns of deep ocean processes - the Navy and the N. S. F. Therefore, Navy should be prepared to carry this load and will need the manpower to do it."

c. Respondent's Comment. "I am still sufficiently naive and incurably optimistic to hope, however, that eventually there will be sufficiently increased centralized cognizance and interagency coordination to reduce the existing, appalling overlap and duplication that persons now engaged in redundant effort will be put to better use."

d. Respondent's Comment. "There is one factor influencing the forecasts which you do not identify: that the Navy's role in ocean affairs will be increasingly, and ultimately exclusively, limited to those things pertaining to defense. The Navy initially was oceanography, as far as the Federal Government was concerned; and could have remained so. Through a curious combination of antagonism, ignorance and apathy in the middle and top levels in the Navy, however, this slipped from our grasp, slowly at first in the early 1960's, and with shocking rapidity in the last three or four years."

e. Respondent's Comment. "...from my experience BUPERS has never developed a satisfactory career pattern for holders of technical limited duty designators with the result that officers who elect to specialize in technical fields do so to the detriment of their professional careers. In the case of Oceanography, I suspect that as civilian opportunities for marine scientists grow the Navy is going to have increasing difficulty holding first class oceanographers in uniform. Unless this situation changes I expect that more and more of the oceanographic functions in the Navy will be taken over by civilians."

f. Respondent's Comment. "Since the early 1960's the major geodetic efforts have been of such magnitude that they have been joint service undertakings and have been administered by the Mapping and Charting Directorate of the Defense Intelligence Agency. As a result the combined talent of all three services plus the National Ocean Survey has been brought to bear on problems which have had high defense priorities...The importance of the Naval officer has been more in the activity in the joint service/DIA arena in solving fiscal and operational problems. The majority of actual field work and analytical work for Navy has been done by civilians."

g. Respondent's Comment. "Civilian participation in the field of oceanography is expected to increase, though not at the rate touted by some. This is still an emerging field that is gaining additional impetus by the current national concern about the environment. The field will expand, especially after concrete benefits are realized from past basic efforts and national focus turns to these accomplishments."

h. Respondent's Comment. "I would expect an increase in the overall number of billets for officers schooled in oceanography. This increase would not be large, it would be due to a recognition that officers with such education could be used in billets at the Flotilla or ship squadron level. Some increase also should be made to fulfill Navy contribution requirements to the ecological and pollution investigations which touch upon Naval interests."

2. Emerging Field Comments: (Total number of comments - 12)

a. Respondent's Comment. "The academic community is increasing its course offerings in environmental problems, marine ecology, waste disposal and ocean engineering. New courses in maritime law and international relations are also being offered. These courses will benefit those officers and

civilians concerned with problems involving ocean and harbor pollution, international treaties and obligations relating to law of the sea and the exploitation of the sea bed for Naval purposes."

b. Respondent's Comment. "Some agency, perhaps Navy, will be involved in policing international agreements with regard to peaceful utilization of the sea bed and concerning meaning of national rights in the marine realm."

c. Respondent's Comment. "At present and for the next decade, the Navy will have more geophysical survey ships at sea than oceanographic survey ships. These ships will be collecting detailed, precise bathymetry, gravity, and magnetic data in the oceans and in foreign coastal areas. There is presently no place in the U. S. Navy, including the PG School at Monterey, that offers adequate instruction leading to an advanced degree for officers or civilians conducting these kinds of survey operations. The best practical course is that offered at the Naval Oceanographic Office - a 52 week course, "Hydrographic Engineering/Marine Environment," developed primarily to train allied naval officers."

d. Respondent's Comment. "If this question refers to general growth in the ocean business rather than qualification for non "blue suiters," then I would say that the most rapid growth area will be the civil use of the ocean's resources. I think this will occur primarily in the mineral resources area. This will involve the making of multi-megabuck decisions based on sound knowledge of the ocean environment and ocean technologies. The Navy should stay close to these developments in order to profit by this substantial non-DOD investment. In addition, I see that we will soon be utilizing space technologies for studies of the world ocean. Remote sensors in aircraft and spacecraft will provide cost-effective means for doing synoptic work which would be prohibitive by conventional ships. We must insure that we have personnel who will be able to work with these new techniques."

e. Respondent's Comment. "If we are to truly have the projected increased reliability and ease of maintenance with consequent reduced manpower our work is cut out for us. We will have to shuck off the different gadgets so far tried for this purpose, which by some mysterious alchemy have always had an inverted effect and take the initiative of saying 'no'."

f. I visualize the following as occupational areas which may impact on NAVY manpower requirements

ECOLOGY, POLAR, MANAGEMENT.

Of these the first two seem clearly referenced in the stated assumptions, and there appears little doubt that more expertise in these areas will be required. Chances are that much of this expertise can and should be developed in NAVY civilian manpower resources; although these subjects should not be neglected in an officer's education he need not be "expert" in the same sense as the civilian scientist.

Management on the other hand is an area wherein the NAVY Officer Oceanographer could greatly benefit from additional education. If one assumes that the officer is a manager rather than scientist then it appears that a speciality/sub-specialty in oceanography coupled with a management education (perhaps dual-masters) could greatly enhance the Navy Officer Oceanographers ability to manage the many and varied NAVY oceanography programs.

g. In this regard it should be recognized that many of the senior shore billets (particularly in the Washington area) involve the practice of managerial and political oceanography and therefore the "grooming" of the P-coded officers in these directions is of considerable importance. One thing which will enhance our regaining the fore in the nation's oceanography effort is an officer oceanographer who is also "a good politician" in a position at or near the top.

h. The sum total of comment raises the question, are our future professional manpower requirements to be determined entirely by force levels and fiscal considerations or shall we through enlightened management determine our real requirements for environmental support, services and products and in turn determine our manpower requirements according to the "workload"? Surely, this last approach is preferable, and, if so, we should determine the real oceanographic requirements as a step toward taking the right course for all of Navy oceanography. Much of the respondent comment hints at this sort of thing. There is recognition of ASW needs, ecological relationships and mapping and charting needs and the changes that the new organization under the Defense Mapping Agency may bring. This brings us back to the senior officers I mentioned in an earlier comment who practice managerial and "political" oceanography. It is up to these people to determine our oceanographic requirements in an educated and rational manner and to provide guidance to all parts of the Naval Establishment with respect to professional manpower needs and utilization.

3. <u>Reported emerging courses/degree fields</u>:

a. Ocean Engineering.
b. Remote sensing of the environment (spacecraft and aircraft).
c. Photo interpretation as related to spacecraft photography.
d. Seismology.
e. Marine Ecology.
f. Marine Science Affairs (Interdisciplinary; interagency coordination; policy planning).
g. Scientific Diving.
h. Tides of the Geosphere.
i. Harbor pollution control.
j. Estuarine Hydrology.

4. <u>Reported emerging occupational fields</u>.

a. Environmental Management particularly as applied to the coastal zone.
b. Mineral exploration and treasure hunting in the ocean.
c. Petroleum production engineering at sea.
d. Base line studies of pollution of the sea.
e. Environmental pollution.
f. Socio/Economic and legal aspects of marine science and engineering.

B. SHIP ENGINEERING FORECAST:

1. <u>Opinion Feedback Comments</u>: (Total number of comments - 31)

a. "A major reorganization of the material and operational branches of the Navy should be implemented to eliminate redundant and unproductive layers which presently exist. A central ship boss in the Systems Command is badly needed plus a mix of capable line and restricted line officers to work together instead of at 'logger heads' from opposing bureaucratic agencies."

b. "I believe that the nation thinks that our military R&D grew at a very rapid rate during the 1950's, and then our emphasis on the scientific competition and space exploration grew at a very rapid rate in the 1960's. Both of these have gotten out of proportion to what we can continue to sustain on a continuing and long term basis. The country and congress will tend to give each only casual attention until other things (urban, human resources, environmental problems) have grown in support. When Defense and Space are back in proportion then they will grow at a rate more commensurate with GNP and total federal budget."

c. "Every technically trained officer ought to have a working background in statistical analysis and also in the principles of financial accounting and control."

d. "As a result of some intensive effort in the proposed reorganization of NAVMAT, I have become convinced that the Navy of the future will have a desperate need for engineering managers in the restricted line. But I do not believe that these needs will ever be met because of a refusal on the Navy's part to recognize that the men that will fill these needs must have an opportunity to command. So long as the paranoia exists among our senior unrestricted line that the well qualified unrestricted officer can do anything and that the restricted line officer is not to be trusted in positions of command, we will remain in trouble."

e. "I would say that our greatest need now is for officers and civilians who understand the seagoing environment, but who can also make rational decisions on proper allocation and application of resources. I believe this will also be true in the future because we continue to be a gadget and a gimmick oriented Navy."

f. "The management responsibilities of the technical part of the Navy are of equal magnitude to those of operational command and the career potential and rewards should be commensurate; otherwise the best people will leave and the Navy will become second best technically as did the British Royal Navy between World War I and World War II."

g. "My figures (change factors) are intended to provide an improvement in Navy capability to manage the technical problems of the next decade - not just hold even."

2. Emerging Fields Comments: (Total number of comments - 28)

a. "I believe a major problem of the future will be the transfer of information between technical groups; particularly between operators, system designers, system builders, and technical managers. I would think certain officers and civilian engineers should be specifically trained to carry out such a transfer of information."

b. "We have new (as of 2-3 years ago) graduate level programs in ocean engineering and in marine systems. The former term is well understood and requires no elaboration here. The latter should be explained, however. In our marine systems program, we prepare students to engage in engineering management and to provide leadership in preliminary ship design--applying principles of systems analysis, engineering

economics, and decision theory. An important and popular branch is in the area of computer aided ship design."

c. "Programs offering Graduate Degrees in Engineering-Economic Systems or similar dual programs dealing with the overall effort involved in planning, operating and controlling large scale technological economic systems are now being offered."

d. "At the Postgraduate School I foresee some re-emphasis on technical manpower needs and in better understanding of the now popular wishes for managers. The Navy has some tough managerial problems ahead that cannot be handled by men who have had management but don't understand the complex technical world they are managing."

e. "In 'Emerging Fields' I would include for the technically educated man, 'Business Management'. In the next decade technical decisions will increasingly be influenced by business, social and political factors. The engineer must have a 'subspecialty' in some discipline of the 'real world'. 'Business Management' doesn't precisely cover my thoughts but it's the closest single 'field' I can think of."

f. "Although not a new degree field, one of the most significant educational changes for naval officers in USNPGS Curriculum #510 (Naval Construction and Engineering at M. I. T.) is the opportunity to earn a graduate degree in management in addition to a graduate technical degree in the field of Naval Construction and Engineering. This program, although very difficult and demanding, is only in its second year. It would seem to be a viable marriage of technical and management education to support assumptions 8 and 9 (Scientists playing major roles, and stress on social improvement at the expense of military requirements)."

g. "The U. S. Navy PG School at Monterey and MIT are offering the so-called dual masters program wherein the three year navy graduate student is able to complete the requirements for a masters degree in both engineering and management. This program is clearly suited for the technical manager."

h. "An area of increasing concern to ship engineering is pollution abatement. This is a problem of growing national concern and an area that the Navy most certainly will be asked to meet its responsibilities. This will include both control devices onboard ships and shore facilities."

i. "Significant new courses are being developed in educational institutions relevant to the technical and management problems of ocean systems. This development is due to the confluence of two new forces: the wider recognition of opportunities and problems in the ocean environment (ocean engineering with and without manned systems) and the sharpening of management tools (systems analysis, study of alternatives, decision making) as taught in engineering schools."

"The evolving organization of generally accepted knowledge relating to quasi-analytic approaches to technical systems management and decision-making has led to proliferation of subject offerings at most progressive schools. Most relevant to the Navy is the rapid development of these subject offerings within schools of engineering, targeted for graduate engineering students. Probabilistic systems, systems economics, analysis of alternatives, and decision-making with or without uncertainty are typical offerings found, for example, in the various departments of the School of Engineering at M. I. T. The teaching and study of technical management is by no means restricted to schools of business. The melding of technical engineering disciplines and technical management education may well be done more in schools of engineering than has been done in accounting, economics, and profit or welfare business administration."

"Significant to the Navy is this dynamic action in technical and technical management education in conjunction with the ocean engineering or ocean systems trends at some institutions."

j. "New courses which could develop into a new curriculum or degree field of interest to the Navy include: courses in ecology and in assessing the environmental impacts of managerial and technical decision-making; interdisciplinary courses such as electrmechanics and bio-engineering; courses in mathematics and statistics as a language/tool for majors in business, economics, sociology, and other non-technical fields; courses in information theory for use in a wide variety of fields; economic courses stressing mathematical/analytic points of view, specifically econometrics."

3. New Degree Fields:

a. Control Systems
b. Human Resources in Engineering
c. Systems Engineering
d. Technology of Ocean Operations

APPENDIX E

SUGGESTED MANAGEMENT CURRICULA

The following subjects are covered in this Appendix:

A. Suggested management programs for oceanography officers, including course descriptions.

B. Suggested combined oceanography/management curriculum.

C. Systems Acquisition Management curriculum, including course descriptions.

D. Defense Management Systems Course outline.

The suggested management curricula discussed in this Appendix are based on courses presently available at the Naval Postgraduate School. It is hoped that new courses, with specific relevancy for the oceanography community, will be developed in the future. The recently established course entitled: International Policy Issues Pertaining to the Environmental Sciences, is an excellent example of the type of courses that might be developed.

Course descriptions provided in this Appendix are available in the current issue of the Naval Postgraduate School Catalogue. They have been included here for ease of reference and for the information of the reader who may not have ready access to a copy of the catalogue.

A. SUGGESTED MANAGEMENT PROGRAMS

Two suggested management programs are provided, and the variety of management courses available would permit the

designing of alternate programs. For this reason, descriptions of several extra courses have been included even though the courses are not listed in the suggested program. The two programs are recommended for the officer who can be made available for the time required to complete the full management curriculum. That is, these programs would apply either to the separate technical and management educational tours or to the Dual Master's Program.

1. General Information

All officers, regardless of designator, are required to participate in "core" courses, which include at least one graduate level course in each of the following areas of study:

Economics	Behavioral Science
Probability and Statistics	Management Theory
Financial Management	Operations Research

It is assumed that several of the core courses could be validated, because of technical courses that had been completed previously. Such validation would permit the scheduling of additional management courses, and the suggested programs were based on this assumption. There are elective courses to permit the officer to specialize in a field of interest to him and to the sponsoring command. These areas of specialization are:

Personnel Management
Financial Management
Material Management
Management Science
Economics

Earlier in this study, it was recommended that the oceanography officer specialize in either the personnel management or economics areas. The other three areas are primarily designed for Supply Corps officers. In any event, the core portion of the program provides courses in each of the three areas.

One further assumption was made: that thesis requirements applicable to the Personnel Management option could be waived. Naval Postgraduate School procedures permit waiving the thesis if 8 quarter hours of approved graduate (4000 level) courses are substituted.

2. Suggested Programs

The following program schedules were designed to meet any prerequisite requirements.

Courses to be Validated:

CS 0110 FORTRAN TV Course
MA 2300 Mathematics for Management
PS 3000 Management Statistics

Codes: *Personnel Management #Economics

First Quarter			Hours
MN 3106	Behavioral Science	(core)	4-0
MN 3140	Microeconomic Theory	(core)	4-0
MN 3150	Financial Accounting	(core)	4-0
MN 3211	Operations Analysis for Management	(core)	3-2
			15-2

Second Quarter			
MN 3105	Theory and Practice of Management	(core)	4-0
MN 3161	Managerial Accounting	(core)	4-0
MN 4145	Systems Analysis	(core)	4-0
*MN 3125	Organizational Behavior and Administration	(ele)	-0
#MN 3130	Macroeconomic Theory	(elective)	-0
			16-0

Third Quarter	Hours
MN 3183 Management Use of Computers (core)	4-0
*MN 4101 Personnel Management and Labor Relations (elec)	4-0
#MN 3142 International Economics (elective)	4-0
*#MN 3147 Labor Economics (elective)	4-0
*#MN 4171 Procurement and Contract Administration (elec)	4-0
	16-0

Fourth Quarter	
MN 4105 Management Policy (core)	4-0
*MN 4121 Seminar in Organizational Theory and Management Practice (elective)	4-0
*MN 4147 Industrial Relations (elective)	4-0
*#MN 4181 Management Information Systems (elective)	4-0
#MN 3770 Industrial Organization (elective)	4-0
#MN 3780 Economics of Regulation (elective)	4-0
	16-0

3. Course Descriptions

Core Courses Descriptions:

MN 3105 THE THEORY AND PRACTICE OF MANAGEMENT (4-0). An introduction to the field of management as a body of knowledge related to a concrete practice. Discusses the various theories of management, their origins, their substances, and their applications to real world situations.
PREREQUISITES: MN 3106, MN 3150, MN 3140, or MN 3141

MN 3106 BEHAVIORAL SCIENCE (4-0). Aspects of individual and group behavior and their influence on organizational effectiveness.
PREREQUISITES: NONE

MN 3140 MICROECONOMIC THEORY (4-0). Determinants of the allocation of resources and the composition of output. Consumer choice theory. Partial equilibrium analysis of the significance of market structure. Introduction to welfare economics using quantitative techniques.
PREREQUISITES: MN 2030 or equivalent; calculus.

MN 3150 FINANCIAL ACCOUNTING (4-0). Study of the basic postulates and principles of accounting. Specific topics include the accounting cycle, asset valuation, equities and capital structure, financial statement analysis, and elementary cost accounting.
PREREQUISITE: None

MN 3161 MANAGERIAL ACCOUNTING (4-0). Survey of cost accounting systems, including overhead costing, job order and process cost systems, variable and absorption costing, and standard costs. Emphasis is on applications of accounting data to planning, control and decision making. Topics covered include flexible budgets, variance analysis, cost-volume-profit analysis, and incremental profit analysis. Capital budgeting is examined extensively.
PREREQUISITE: MN 3150.

MN 3183 MANAGEMENT USES OF COMPUTERS (4-0). Study of manual, semi-automatic, and automatic systems for the routine processing of data. Specific topics covered include accounting and auditing applications, sequential and random processing with digital computers, and control techniques. Students in small teams will study actual industrial and/or military management situations and recommend appropriate data processing systems.
PREREQUISITES: CS 0110, PS 3000, MN 3105

MN 3211 OPERATIONS ANALYSIS FOR MANAGEMENT I (3-2). Introduction to the philosophy and methodology of operations research. Survey of some of the more elementary techniques relating to decision making and optimization.
PREREQUISITE: PS 3000

MN 4105 MANAGEMENT POLICY (4-0). Study and appraisal of a variety of policies requiring the analysis of problems and the formulation of decisions in both business and governmental enterprises. Use of case material, management games, and other devices as exercises in decision making and the executive action under conditions of uncertainty and change.
PREREQUISITE: Open only to students in their final quarter of the Management Masters Program.

MN 4145 SYSTEMS ANALYSIS (4-0). This course will concentrate on the analysis of large scale defense resource allocation problems, using cost-effectiveness models. Topics include: discounting, constrained optimization, estimation problems, and efficiency over time. Systems analysis case studies will be emphasized.
PREREQUISITE: MN 3150, MN 3141 or MN 3140, MN 3161 (concurrently), PS 3000 (concurrently).

Elective Courses Descriptions:

MN 3043 ECONOMIC DEVELOPMENT (4-0). Goals and problems of economic development. Theoretical and policy issues, approaches to economic development, market system vs. public planning.
PREREQUISITES: MN 3130, MN 3141, or MN 3140.

MN 3046 COMPARATIVE ECONOMIC SYSTEMS (4-0). The characteristics and functions of an economic system. Criteria for evaluating the performance of contemporary economics. The analysis of alternative patterns of control, planning and market structures under capitalism, socialism, and mixed economics.
PREREQUISITES: MN 3140 or MN 3141 and MN 3130.

MN 3110 INDIVIDUAL BEHAVIOR (4-0). Study of the basic characteristics and determinants of individual behavior. Specific topics covered include personality, motivation, learning, behavior conditioning, and introduction to tests and measurements. Implications for effective administrative practice.
PREREQUISITE: MN 3106.

MN 3121 GROUP AND ORGANIZATIONAL BEHAVIOR (4-0). Studies of small group behavior and the relationship between the individual and the group. Survey of organization theory, including organizational structure, controls and systems. Analysis of decision making processes in organizations, of leadership, of factors affecting organizational growth and development.
PREREQUISITE: MN 3106.

MN 3125 ORGANIZATIONAL BEHAVIOR AND ADMINISTRATION (4-0). Analysis of human situations within organizations and their administrative implications. The course focuses on the responses made by individuals and groups to the influences bearing upon their behavior in organizational settings.
PREREQUISITE: MN 3106.

MN 3130 MACROECONOMIC THEORY (4-0). Development of macroeconomic models to analyze the relationships between aggregate demand, debt and financial assets, rate of technical advance, and national income. The monetary system and international monetary relationships.
PREREQUISITE: MN 2030 or equilivent.

MN 3135 SELECTED TOPICS IN ECONOMICS (2-0 to 5-0). Presentation of a wide selection of topics from the current literature. This course may be repeated for credit if course content changes.
PREREQUISITE: A background in economics and Departmental approval.

MN 3142 INTERNATIONAL ECONOMICS (4-0). A study of international economic theory and international finance. Major topics include trade and resource allocation, the balance of payments, the foreign exchange market, and international economic equilibrium. Special emphasis on the relationship of DOD to international trade and finance.
PREREQUISITES: MN 3140 or MN 3141, MN 3130.

MN 3143 MANAGERIAL ECONOMICS (4-0). Microeconomic theory and its applications and capital budgeting; significance of market structure upon performance, investment decisions and capital budgeting. Case and industry studies.
PREREQUISITE: MN 2030 or equivalent.

MN 3147 LABOR ECONOMICS (4-0). Development of the labor movement, its organizational structure, ideologies, policies and practices. Alternative theories of wage determination. Effects of unions on wages and rate of technical change.
PREREQUISITE: MN 3141 or MN 3140.

MN 3445 LINEAR ECONOMICS I (4-0). Development and application of linear models to the specification and control of economic relationships. Input-output models of the American economy; linear programming models of the firm; linear production functions and dynamic input-out models.
PREREQUISITE: MN 3140 or MN 3141.

MN 3645 INVESTIGATIVE METHODS OF ECONOMICS I (4-0). Development and applications of selected statistical techniques. General linear hypothesis and regression theory. The Gauss-Markoff theorem; analysis of variance and hypothesis testing. Stochastic processes and their application.
PREREQUISITES: MN 3140 or MN 3141, PS 3000.

MN 3770 INDUSTRIAL ORGANIZATION (4-0). Analysis of the structure, conduct and performance of American industry. Public policy issues, implementation of anti-trust and other business legislation.
PREREQUISITES: MN 3140 or MN 3141, PS 3000.

MN 3780 ECONOMICS OF REGULATION (4-0). Analysis of regulatory alternatives and market performance in selected economic settings. Federal Government regulatory practice; communication; air; rail, and highway transportation; petroleum; product standardization; Armed Service Procurement Regulation. Applications of the public utility concept. State and local government practices.
PREREQUISITE: MN 3140 or MN 3141.

MN 4101 PERSONNEL MANAGEMENT AND LABOR RELATIONS (4-0). Study of the principles and practices of personnel administration in business and government organizations. A survey of the history, development and current status of labor-management relations in industry and government. Analysis of the economics of the labor market and the implications of government regulations for wages and labor-management bargaining practices.
PREREQUISITES: MN 3106 and MN 3141 or MN 3140.

MN 4111 SEMINAR IN BEHAVIORAL SCIENCE (4-0). A combination of directed readings and individual student's research projects presented for discussion in class. Emphasis is placed on empirical analysis of behavioral patterns and relationships.
PREREQUISITE: Departmental approval.

MN 4112 PERSONNEL SELECTION AND CLASSIFICATION (4-0). Analysis of human performance within organizations. This course considers the methods available for measuring and predicting the performance of the members of organizations. Methods of measuring differences between people via employment interviewing, testing, and life-history data are discussed. Techniques for studying and recording job behavior are also considered. In addition, the various strategies for personnel decisions are discussed in terms of validation, and selection and placement models.
PREREQUISITES: MN 3110 and PS 3000.

MN 4113 PERSONNEL TRAINING AND DEVELOPMENT (4-0). Determination of the skills, knowledges and attitudes in which people should be trained. Analysis of who should be trained and the methods currently available for training are discussed. Techniques available for evaluating the efficiency of training are also considered.
PREREQUISITES: MN 3110, PS 3000 (may be taken concurrently).

MN 4114 PERSONNEL PERFORMANCE EVALUATION (4-0). Current methods of appraising the work performance of individuals in different types of work are reviewed. Problems associated with each method are analyzed. Performance evaluation is examined as a system interfacing with selection, classification, training, advancement, and retention.
PREREQUISITES: MN 3106 and PS 3000.

MN 4115 PERSONNEL MOTIVATION (4-0). A brief summary of the traditional theories of motivation is given. Several motivation to work theories are discussed along with the research concerning these theories. Current research on the roles of compensation in personnel motivation is considered.
PREREQUISITE: MN 3110.

MN 4121 SEMINAR IN ORGANIZATION THEORY AND MANAGEMENT PRACTICE (4-0). A research and discussion approach to the problem areas of organization theory, management practice, and the contributions of various theoretical disciplines to the evolving sciences of management. Particular attention is given to the implications of changes in the environment of organizations, in their internal technology, and in the state of knowledge about human behavior.
PREREQUISITE: Departmental approval.

MN 4130 MACROECONOMIC POLICY (4-0). Development and application of aggregate economic models to selected policy issues. Emphasis will be placed upon the use and interpretation of econometric models.
PREREQUISITES: MN 3130, and MN 3141 or MN 3140.

MN 4135 MONETARY ECONOMICS (4-0). The interrelations between monetary and non-monetary variables in the economy.
PREREQUISITES: MN 3130, and MN 3140 or MN 3141.

MN 4141 ECONOMIC THEORY AND MICROECONOMIC POLICY (4-0). Further developments of the concepts of imperfect competition and economic efficiency. Pricing and price-making policy issues. Introduction to economics of risk aversion. Analyses of major U. S. industries and government policies.
PREREQUISITES: MN 3130, and MN 3140 or MN 3141.

MN 4147 INDUSTRIAL RELATIONS (4-0). Development of the institutions and techniques for resolving conflict over wages and conditions of work. Theories of bargaining and arbitration.
PREREQUISITE: MN 3147.

MN 4152 DECISION MAKING FOR FINANCIAL MANAGEMENT (4-0). The management of the finance function in government and industry. Specific topics include cash and working capital management, long-term financing, determination of optimal capital structure, and valuation of a going concern.
PREREQUISITES: MN 3161 and PS 3000.

MN 4171 PROCUREMENT AND CONTRACT ADMINISTRATION (4-0). Study of the elements of the procurement cycle, including the determination of the requirements, contract law, technical and production problems, fiscal controls, facilities, inspections, and terminations. Military procurement regulations are analyzed to determine their impact on efficient military logistic systems.
PREREQUISITE: MN 3161, MN 4145.

MN 4172 MARKETING STRATEGY (4-0). Research and study of areas of marketing that are applicable to management strategy. Typical areas to be considered are: sensitivity to the environment; value of analytical tools; behavioral considerations; creativity and innovative approaches; marketing research as a tool; influence of Federal statutes.
PREREQUISITES: MN 3211

MN 4181 MANAGEMENT INFORMATION SYSTEMS (4-0). Study of the "total systems" concept. Development and discussion of an integrated information system, employing a computer and data

processing equipment, used by management for planning and control purposes. Analysis of actual information systems used in industry and the government.
PREREQUISITES: MN 3150, MN 3183 and CS 0110

MN 4191 QUANTITATIVE DECISION TECHNIQUES (4-0). A study of the applications of scientific techniques, particularly mathematical and statistical, to management decision making. Consideration of application of quantitative methods of analysis to complex problems with the aid of computers.
PREREQUISITES: CS 0110, MN 3211, and MN 3212.

MN 4225. LABOR LAW (4-0). Labor Law as it affects management, labor and the public with special emphasis on legal problems confronting military personnel in managerial situations.
PREREQUISITE: MN 4101.

B. SUGGESTED COMBINED OCEANOGRAPHY/MANAGEMENT CURRICULUM

The suggested program for a combined oceanography/management curriculum is provided below. This program was designed to retain the essential oceanography courses, and it is believed that this program will provide substantially the same technical background in oceanography as the existing curriculum. Most of the forecasting courses were eliminated to allow scheduling of the management courses. It should be remembered that this curriculum was recommended for the officer who requires the general oceanography background in order to perform more effectively in a technical manager role.

In the case of the management portion of the program, the majority of the existing management core courses were included. Several of the most relevant management elective courses also were scheduled. Scheduling of courses in particular quarters was designed to meet prerequisite requirements for both the

oceanography courses and the management courses. It is recommended that officers following this curriculum be permitted to select a thesis topic in an oceanography related management area if so desired.

First Quarter		Hours
OC 0110	Faculty Seminar	1-0
OC 2120	Survey of Oceanography	4-0
MR 2200	Introduction to Meteorology	4-0
MR 2205	Introduction to Meteorology Analysis	0-4
MA 2047	Linear Algebra and Vector Analysis	4-0
MA 2121	Differential Equations	4-0
		17-4

Second Quarter		
MA 3132	Partial Differential Equations and Integral Transforms	4-0
PS 3000	Management Statistics	5-0
OC 3221	Descriptive Physical Oceanography	4-0
OC 3420	Biological Oceanography	3-3
		16-3

Third Quarter		
MA 3232	Numerical Analysis	4-0
MN 3106	Behavioral Science	4-0
MN 3150	Financial Accounting	4-0
OC 3320	Geological Oceanography	3-3
		15-3

Fourth Quarter		
MN 3205	Theory and Practice of Management	4-0
MN 3211	Operations Analysis for Management	3-2
OC 3150	Geophysical Random Processes	3-1
OC 4321	Introductory Geophysical Fluid Dynamics	4-0
		14-3

Fifth Quarter		
MN 3140	Microeconomic Theory	4-0
MN 4145	Systems Analysis	4-0
OC 3520	Chemical Oceanography	3-2
OC 4211	Waves and Tides	4-0
		1[illegible] 2

Sixth Quarter		Hours
OC 0810	Thesis Research	0-0
OC 3260	Sound in the Ocean	3-0
OC 3710	Oceanographic Cruise Planning and Field Experience	2-4
OC 4213	Coastal Oceanography	3-1
OC 4322	Ocean Circulation	4-0
		12-5

Seventh Quarter		
OC 0810	Thesis Research	0-0
OC 3000/4000	Elective*	4-0
MN 4171	Procurement and Contract Administration	4-0
MN 4181	Management Information Systems	4-0
		12-0

Eighth Quarter		
OC 0810	Thesis Research	0-0
OC 4900	Seminar in Oceanography	2-0
GV 3901	International Policy Issues Pertaining to the Environmental Sciences	4-0
MN 4105	Management Policy	4-0
		10-0

	Oceanography	Management
Total 3000 level courses	29-17	22-2
Total 4000 level courses	17- 1	20-0
Total Graduate level courses	50-14	42-2

*It is recommended that the 3000/4000 level elective be a course related to environmental problems, such as: Pollution problems and solutions; marine ecology; or marine affairs.

Sixth Quarter		Hours
OC 0810	Thesis Research	0-0
OC 3260	Sound in the Ocean	3-0
OC 3710	Oceanographic Cruise Planning and Field Experience	2-4
OC 4213	Coastal Oceanography	3-1
OC 4322	Ocean Circulation	4-0
		12-5

Seventh Quarter		
OC 0810	Thesis Research	0-0
OC 3000/4000	Elective*	4-0
MN 4171	Procurement and Contract Administration	4-0
MN 4181	Management Information Systems	4-0
		12-0

Eighth Quarter		
OC 0810	Thesis Research	0-0
OC 4900	Seminar in Oceanography	2-0
GV 3901	International Policy Issues Pertaining to the Environmental Sciences	4-0
MN 4105	Management Policy	4-0
		10-0

	Oceanography	Management
Total 3000 level courses	29-17	22-2
Total 4000 level courses	17- 1	20-0
Total Graduate level courses	50-14	42-2

*It is recommended that the 3000/4000 level elective be a course related to environmental problems, such as: Pollution problems and solutions; marine ecology; or marine affairs.

C. SYSTEMS ACQUISITION MANAGEMENT CURRICULUM

<u>Objective</u>: To provide selected officers with an advanced education in the fundamental concepts, methodology, and analytical techniques required for the life cycle management of the planning and acquisition of defense systems. [4]

<u>Description</u>: This six-quarter program is designed to fulfill the Navy's expanding needs for project management personnel to staff designated program offices and related activities having systems acquisition management responsibilities. In addition to basic "core" courses, which provide the foundations and tools for project management, students take specialized courses dealing with systems acquisition disciplines. Classroom instruction includes lectures, case studies, problem exercises, and seminars. These afford the student the opportunity to participate in a project environment and to hear discussions of systems acquisition management topics presented by senior Naval officers and program managers. Individual or group theses, including the simulation of a project office, focus the courses taken into the solution of a significant program exercise as a culminating experience.[4]

The normal program followed by students enrolled in the Systems Acquisition Management curriculum is as follows:

<u>First Quarter</u>		<u>Hours</u>
SM 3301	Introduction to Systems Acquisition	4-0
MN 3150	Financial Accounting	[illegible]-0
SM 3302	Fundamentals of Project Management	[illegible]-0
OS 3201	Fundamentals of Operations Analysis	[illegible]-0
SM 0001	Seminar	0-2
		16-2

In addition, those students with no prior computer programming experience will be enrolled in CS 0110 if not completed during the refresher period.

Second Quarter		Hours
MN 3141	Microeconomics	4-0
MN 3161	Managerial Accounting	4-0
SM 3304	The Behavioral Sciences and Project Management	4-0
OS 3202	Methods of Operations Analysis/Systems Analysis	4-0
SM 0001	Seminar	0-2
		16-2

Third Quarter		
MN 4145	Systems Analysis	4-0
OS 3203	Survey of Operations Analysis/Systems Analysis	4-0
SM 3305	Project Information Systems	4-0
OA 4662	Reliability and Weapons System Effectiveness Measurement	4-0
SM 0001	Seminar	0-2
		16-2

Fourth Quarter		
SM 4303	Procurement Planning and Negotiation	4-0
SM 4302	Public Expenditure, Policy, and Analysis	4-0
SM 4301	Systems Engineering Management	4-0
SM 0810	Thesis Research	0-0
SM 0001	Seminar	0-2
		12-2

Fifth Quarter		
SM 4304	Contract Administration	4-0
MN 4101	Personnel Management and Labor Relations	4-0
SM 4305	Logistic Support	4-0
SM 0810	Thesis Research	0-0
SM 0001	Seminar	0-2
		12-2

Sixth Quarter		
MN 4172	Marketing Strategy	4-0
	Elective (3000/4000 level MN, OA, CS, SM course)	4-0
	Elective (3000/4000 level MN, OA, CS, SM course)	4-0
SM 0810	Thesis Research	0-0
SM 0001	Seminar	0-2
		12-2

Course Descriptions:

Most management (MN) course descriptions can be found in Section A of this Appendix.

SM 3301 INTRODUCTION TO SYSTEMS ACQUISITION (4-0). This course provides students with an overview of the Systems Acquisition process, its underlying philosophies and concepts, its application in the Department of Defense and the Navy, and established the foundations for other courses in the curriculum. Topics covered include the evolution of systems acquisition management, the systems approach, the system life cycle and defense system acquisition cycle, user-producer dialogue, Navy life cycle management philosophy, and systems acquisition management disciplines and activities.
PREREQUISITE: None

SM 3302 FUNDAMENTALS OF PROJECT MANAGEMENT (4-0). Study of the principles of management as a body of knowledge related to practice. Discusses the functions of management planning, organizing, staffing, directing, and controlling--as they apply within industry and government. Specific application of these principles and functions to project management are investigated.
PREREQUISITE: None

SM 3304 THE BEHAVIORAL SCIENCES AND PROJECT MANAGEMENT (4-0). Study of the field of behavioral science as a body of knowledge related to a concrete practice. Discusses the functions of management as they apply to the achievement of purposes by individuals and groups within an industrial or government organization. Examines various aspects of individual and group behavior and their influence on organizational effectiveness. Specific concepts include traditional contemporary management theory; individual and group dynamics; motivation and control in the organizational setting.
PREREQUISITE: SM 3302

SM 3305 PROJECT INFORMATION SYSTEMS (4-0). The course provides a fundamental grounding in computer operations. Material covered includes hardware and software systems, a survey of the various higher level programming languages, examples of computer systems applications, and the concepts of design of management information systems. Particular attention is paid to project management systems.
PREREQUISITES: CS 0110, SM 3301, SM 3302.

SM 4301 SYSTEMS ENGINEERING MANAGEMENT (4-0). This course covers technical management as applied to the Systems Acquisition process. It emphasizes the life cycle integration of the various systems engineering disciplines. Topics include systems engineering, the system life cycle and system design process, systems engineering disciplines and their integration, systems engineering management during concept formulation, system definition, full scale development, production and deployment.
PREREQUISITES: SM 3301, SM 3302, OA 4662.

SM 4302 PUBLIC EXPENDITURE, POLICY AND ANALYSIS (4-0). The process of national decision-making particularly as reflected in the defense budgeting process. Models of budget decision making, including de-centralization. Application of social choice concepts. Applications from the defense budgeting process.
PREREQUISITES: MN 3161, MN 4145

SM 4303 PROCUREMENT PLANNING AND NEGOTIATION (4-0). Study of the procurement planning phase of the procurement cycle, including the determination of need, basic contract law, methods of procurement, fundamentals of the Armed Services procurement regulations and current procurement management techniques.
PREREQUISITES: SM 3301, SM 4301 (concurrently).

SM 4304 CONTRACT ADMINISTRATION (4-0). Study of the solicitation and negotiation of defense procurement contracts, including multiple incentive contract negotiation and administration, managing contract progress, change control, cost control, subcontracting regulations and administration, product acceptance and contract termination.
PREREQUISITE: SM 4303.

SM 4305 LOGISTIC SUPPORT (4-0). This course defines and describes the major fields of logistic support and introduces various models of logistical areas. These areas of support include: personnel, consumables, facilities, material transportation and maintenance. The field of integrated logistics support is introduced along with trade-offs between types of support in optimizing support systems. Data bases and techniques for determination of support requirements are treated briefly.
PREREQUISITE: SM 4301

MN 3141 MICROECONOMICS (4-0). Determinants of the allocation of resources and the composition of output. Consumer behavior and utility theory; theories of the firm; significance of market structure.
PREREQUISITE: MN 2030 or equivalent.

OS 3201 FUNDAMENTALS OF OPERATIONS ANALYSIS (4-0). An introduction to quality assurance elements including design reliability assessment, production assessment testing, environmental testing, system reliability demonstration. Introduction to cost effectiveness analysis. Elements of probability and statistics developed as needed.
PREREQUISITE: Differential and Integral Calculus.

OS 3202 METHODS OF OPERATIONS ANALYSIS/SYSTEMS ANALYSIS (4-0). Methodology of operations analysis/systems analysis. Statistical estimation, and hypothesis testing. Life testing plans, point and interval estimates and reliability parameters. Elements and systems analysis pertaining to redundancy, maintainability, and spares. The role of systems analysis in solving military problems.
PREREQUISITE: OS 3201 or equivalent.

OS 3203 SURVEY OF OPERATIONS ANALYSIS/SYSTEMS ANALYSIS (4-0). A survey of the military applications of operations analysis/systems analysis techniques of particular interest to the student. The applications usually covered are selected from decision, waiting lines resource allocation, replacement, cost-effectiveness, inventory theory, and search models. The techniques needed for these applications are developed as required and usually include topics in linear programming (including the simplex method), probability theory, nonlinear programming, statistics (including Bayesian and classical), dynamic programming and simulation.
PREREQUISITE: PS 3411 or equivalent.

OA 4662 RELIABILITY AND WEAPONS SYSTEM EFFECTIVENESS MEASUREMENT (4-0). Component and System reliability functions and their point and interval estimates under various sampling plans. Review of selected MILSTD reliability of documents and the WSEIAC reports. Reliability and System effectiveness measurement and analysis of the Fleet Ballistic Missile Weapon System and other selected Weapons systems. Measurement indices for Weapons System Effectiveness.
PREREQUISITE: OA 4705 (may be taken concurrently) or equivalent.

D. DEFENSE MANAGEMENT SYSTEMS COURSE

Objective:

To provide an appreciation of the concepts, principles, and methods of defense management as they concern planning, programming, budgeting, and related activities. The course covers force planning, Department of Defense programming program budgeting, and their interrelationships with re[illegible]urce

management systems. Emphasis is placed on the analytical aspects of management, including requirements studies, systems analysis cost/effectiveness, cost estimating and analysis.

Students are not expected to become experts or technicians in the various disciplines and subjects included in the curriculum. The objectives are to provide orientation on the overall functioning of the defense management process, insights as to what defense management requires in the way of inputs and analyses for decision-making, understanding of the principles, methods and techniques used, and awareness of the interfaces between management requirements of the Department of Defense components and the Office of the Secretary of Defense.

Course Description:

The Defense Management Systems Course examines management problems of strategy, implementation, and operations in terms of how analysis and management systems can aid decision-making and management control. Following an introductory force structure planning game, emphasis is placed upon the building blocks of decision theory -- management theory, quantitative reasoning, and economic reasoning. With this fundamental background established, tools and methods of analysis are illustrated as an aid to better decision-making. Then, the role of management systems to support the manager in decision-making and control is developed. Primary attention is focused upon the overall Resources Management Systems of the Department of Defense, including planning, programming, budgeting, and accounting. Throughout the course, work problems and case studies are used to illustrate the roles of analysis and management systems to improve defense management. The course is under continuous development and modification.

DEFENSE MANAGEMENT SYSTEMS COURSE
ILLUSTRATIVE CURRICULUM

I. ORIENTATION

A. Force Structure Game
B. Introduction to the Course
C. Introduction to Defense Management Systems

II. MANAGEMENT THEORY

A. The World of Change
B. Functions of Management
C. National Objective
D. The World Environment
E. International Aspects of Defense Planning

III. QUANTITATIVE REASONING

A. Introduction to Quantitative Reasoning
B. Basic Tools of Quantitative Reasoning
C. Non-Linear Functional Forms
D. How Quantification Aids Decision-Making
E. Building and Using Mathematical Models in Management Decision-Making
F. Mathematics of Marginal Reasoning
G. Risk, Certainty and Uncertainty
H. A Statistical Approach to Decision-Making
I. Describing Data with Statistics
J. Effective Management Under Conditions of Certainty, Risk and Uncertainty
K. Probability and Statistics: Aid to Management
L. Deciding When Significant Change Has Occurred
M. Predicting the Future to Improve Decision-Making
N. Deciding What Causes Change
O. Planning Experience to Get New Knowledge I and II

IV. ECONOMIC REASONING

A. Functioning of an Economic System
B. Resource Available for Defense
C. Economy and Efficiency
D. Decision-Making at the Margin
E. Economic Concepts
F. Marginal Reasoning
G. Production Analysis
H. Exchange Curves
I. Techniques of Economic Analysis
J. Cost-Effectiveness Analysis

V. ANALYSIS: AID TO DECISION-MAKING

A. Analysis of Dynamic Problems
B. Cost Analysis
C. Cumulative Cost - Quantity Relationships
D. Problems in Cost Estimating Relationships
E. Introduction to Effectiveness Analysis
F. Methodology of Effectiveness Analysis
G. Applications of Effectiveness
H. Sensitivity Analysis
I. Investment Analysis
J. Psychological Dimensions of Decisions
K. Systems Analysis
L. Analytical Decision-Making

VI. RESOURCES MANAGEMENT SYSTEMS FOR PROBLEMS OF STRATEGY, IMPLEMENTATION AND OPERATIONS

A. Evolution of Federal Budgeting
B. Program Budgeting
C. Policy Formulation
D. DoD Concept of Strategic Planning
E. Systems Analysis and Strategic Planning
F. Programming and Budgeting
G. Budget Presentation and Approval
H. Management of Implementation
I. Acquisition Management
J. Program Analysis
K. Management Control
L. Budget Execution
M. Government Accounting
N. Resource Management Systems
O. Project PRIME
P. Management of Operations
Q. Analysis of Operations
R. Problems of Output

APPENDIX F

The following paper was an unpublished manuscript written by Commander Donald Walsh, USN, who holds a PhD degree in Oceanography.

THE EDUCATION OF NAVAL OFFICERS IN OCEAN SCIENCES AND TECHNOLOGY

I. The requirements for specialized training:

1. Seapower and national security - The expansion of historical concepts of seapower into the third dimension of the world ocean dictates development of a commensurate military capability. Seapower establishes the umbrella under which economic exploitation of the oceans can proceed; the ultimate sanction of seapower is naval force. A primary concern for the Navy is the creation of a strong military capability in inner space through accelerated development of the requisite data and technology.

2. Advanced data and technology requirements - Since advancement of military technology is generally prerequisite to other uses of inner space it is here that the "frontier" is found in scientific exploration and technological development. The term "mission oriented" is often applied to the specialization of military need over civilian requirements, but this is not true in this situation. With small exception military and civil requirements for the oceans will be similarly met; the difference is in the time frame and the priori-

of activities. Thus much of the Navy investment in this environment will carry over into the area of ocean exploitation. Nevertheless, at present, the Navy is faced with pioneering much of this future in the world ocean. The current exponential increase in scientific and technological development and its application to 71% of our planet will require the finest management skills that the Navy can organize.

3. <u>Magnitude of funding</u> - The military program in the oceans now operates at about 50% of the total national program for ocean sciences and technology. Navy requirements and activity far exceed those of any of the other 22 federal agencies with ocean programs. In dollars (depending on how you count "ocean programs") the Navy effort is funded at about one-half billion dollars a year. This is not great as major military programs go however when this level is compared to the projections of future requirements we can see the possibility of rapid increases in a short period of time. This would be especially true when the Vietnam conflict is reduced or terminated. Trained manpower for the management of contemporary and projected programs can not be created either by proclamation or legislation......it must be the result of long lead time training.

4. <u>The costs of inexperienced management</u> - With science and technology accelerating development the Navy cannot afford to profitably continue the "all purpose line officer" concept in R&D management. In addition the complexity of fleet

operations require operating personnel with more sophisticated backgrounds. The old way of expecting the officer to learn at the expense of the job will cause increasing losses in resources and time that cannot be accepted. The answer lies in selective training to various levels of proficiency in ocean sciences and technology.

II. Levels of experience and training regimes required:

1. Basic officer level - Instruction in the basic principles of ocean sciences and technology and their application to naval warfare should be a basic part of officer training at the basic level. These subjects should be considered as much of "the arts of the military mariner" as seamanship, navigation, naval engineering and gunnery. Such training at these early stages would tend to build strong foundations within the officer corps upon which to establish a more vigorous approach to the problems of inner space.

2. Applications level - This refers to applied environmental training for the "operator" to improve effectiveness of detection and weapons systems. For example, a short course in "tactical oceanography" would teach the destroyer officer how observable changes in the ocean near his ship could measurably improve sensor and weapons performance. Quite properly this type of training would be conducted at the fleet school level.

3. The subspecialist - In general this refers to post graduate training to the minimal professional level within the

disciplines (i.e. masters degree) in ocean-related subjects. Two broad areas of employment for these officers are established:

a. Applications, through performance in fleet operational billets such as a staff specialist or in a shipboard billet requiring this subspecialty.

b. Management, through assignment to R&D programs at either the headquarters or laboratory levels.

The subspecialist level is the "bridge" between the fleet and the R&D establishment. He represents the ultimate customer...the operator in the fleet, and as a line officer returns to the fleet periodically to maintain currency with fleet problems and procedures. This direct communication between producer and user provides an effective and timely feedback to the shoreside of the Navy.

4. <u>The military specialist</u> - This level is now established, in part, by the new Special Duty Officer category in geophysics (18XX designator) which is to be initiated in May 1969. The oceanography SDO (182X) will draw from trained officers who wish to devote their full career efforts to this field. While the "bridge" advantage is lost here, since they will not return to fleet operations as line officers, there is an offsetting advantage in the establishment of continuity of management. A small percentage of naval officers involved in ocean-related R&D should be from this category to insure naval oriented continuity. For this reason it is reasonable to expect

that a SDO category will be soon established for ocean technology. Since these officers will always work within this specialty additional education (PhD level, advanced management, etc.) would be worthwhile for the improvement of their skills.

5. The civilian specialist/professional - This non-military level recognizes the ultimate need for in-house (civil service) expertise at both working and management planes. It is here that the full-time professional in one of the ocean disciplines would be employed as academician, scientist and planner. Properly, the role of the specially trained naval officer would be to supervise and manage these civilian professionals.

6. The senior manager - This refers to the highest level executive training provided selected senior officers at institutions such as The Naval War College, The National War College, etc. The Navy's top management candidates must be intimately aware of the potential, problems and general dimensions of our nation's future in inner space. From a military point of view this is "a range that only the Navy can ride", but to do this we must insure that the highest levels are conversant with all aspects of the situation. Since this level of management is the source of all policy and directive action for the Navy working levels the importance of training at the top is not to be underestimated. Bec use environmental considerations pervade (or should prevail,

every major naval policy decision, the existing situation of having a few self-informed senior officer "champions" is unsatisfactory and inefficient.

III. <u>The concept of the "enlightened manager"</u>:

1. <u>Pragmatic training for the officer subspecialist</u> - The line officer subspecialist as link between operator and laboratory must be versed in the <u>applications</u> of ocean sciences and technology to fleet requirements. Classical education in science and engineering disciplines can be excessively theoretical with minimal stress on applications. A way to avoid this in officer training would be assignment to applied R&D projects during summer periods or for thesis work.

2. <u>The ocean educated naval officer is not expected to perform as a professional in his discipline</u> - This means that the purpose of this education is not to create new scientists and engineers "at the workbench". The role of both the officer specialist and subspecialist is to provide enlightened management within their fields of specialization. This insures that worthy programs are supported, bad ones are cancelled and that needed work is initiated. The interface between contractor, scientist, engineer and the Navy is bridged by the specially trained officer resulting in more efficient use of resources.

3. <u>Management training for the officer specialist (SDO)</u> - The officer who converts from subspecialist to specialist should be considered for immediate additional training in research and development management. He will be used in a career of professional naval management of science and technology so this additional education would be of long term value to the Navy. In the civilian world R&D management has become a respected sub-field of management studies with all the attendant trappings of journals, conferences, etc. As the largest organization in the ocean business the Navy cannot afford to do less.

4. <u>Senior officer management responsibilities</u> - In the highly competitive struggle for the defense dollar it is imperative that our highest echelons of policy formulation are conversant with naval requirements for the world ocean. The senior level training mentioned earlier can equip these "top executives" with the necessary perspective.

LIST OF REFERENCES

1. Cummings, E. M., Captain, USN, "Navy Needs for Officers in Oceanography," 8th U. S. Navy Symposium of Military Oceanography, 18-20 May 1971, Proceedings, Vol. I, p. 53-61, U. S. Naval Postgraduate School, Monterey, Ca., May 1971.

2. Featherston, Frank H., Captain, USN, "This Business of Project Management," U. S. Naval Institute Proceedings, Vol. 98, No. 1, p. 23-29, Annapolis, Md. January 1972.

3. Ecker, H. Paul, "From Ideas to Action," The BAROMETER, Vol. IX, No. 6, p. 1-2, U. S. Naval Postgraduate School, Monterey, Ca. 22 May 1972.

4. Naval Postgraduate School Catalogue for 1972-1974, U. S. Naval Postgraduate School, Monterey, Ca.

5. "An Overview of Command Opportunity," The Officer Personnel Newsletter, Bureau of Naval Personnel, Vol. 15, No. 4, p. 3, Washington, D. C. March 1972.

6. Lilienthal, David E., "Management: A Humanist Art," Benjamin F. Fairless Memorial Lectures, Carnegie Institute of Technology, New York, Columbia University Press, 1966.

7. "CNO Policy Statement on Specialization in Warfare Subcategories," The Officer Personnel Newsletter, Bureau of Naval Personnel, Vol. 16, No. 1, p. 2-3, Washington, D. C. July 1971.

8. Memorandum for the Deputy Chief of Naval Operations (Manpower and Naval Reserve), (OP-01), OP-01BE/ta Serial 13381P10, Subject: Forecast of Professional Manpower Requirements in the Field of Ship Engineering, 28 July 1972.

9. Secretary of the Navy Instruction 1520.4A, Subject: Policies on Graduate Education for Military Officers, 2 July 1971.

10. Chief of Naval Operations Notice 1211, Subject: Navy-Wide Review of Subspeciality-Coded Billets, 22 January 1971.

11. OCEANAV message 172246Z Dec 1971, Subject: Navy Sub-specialty Billet Review. December 1971.

12. Annual Officer Billet Summary (Senior Officer Edition), NAVPERS 15993, p. 47-48, Bureau of Naval Personnel, Washington, D. C., 15 February 1972.

13. Superintendent's Statement to U. S. Naval Postgraduate School Board of Advisors, Sixth Meeting, 5-6 November 1970, U. S. Naval Postgraduate School, Monterey, Ca., November 1970.

14. James, J. M., Commander, USN, Electronics/Communications Engineering and Communications Management Curricular Officer, U. S. Naval Postgraduate School, Personnel communication. Monterey, Ca., August 1972.

15. Redman, William E., Jr., Evaluation of the Navy's Computer Systems Management Curriculum, Directed Study, Appendix H, U. S. Naval Postgraduate School, Monterey, Ca., 14 December 1970.

16. Superintendent's Statement to the U. S. Naval Postgraduate School, Board of Advisors, Seventh Meeting, 11-12 November 1971, U. S. Naval Postgraduate School, Monterey, Ca., November 1971.

17. "Weapons Systems Acquisition Manager (WSAM)," The Officer Personnel Newsletter, Bureau of Naval Personnel, Vol. 16, No. 1, p. 5, Washington, D. C., July 1971.

18. Ecker, H. Paul, "Educating Management at the Navy Management Systems Center," The BAROMETER, Vol IX, No. 6, p. 2-3, U. S. Naval Postgraduate School, Monterey, Ca., 22 May 1972.

19. "Deep Cuts Planned in Navy Commands," Navy Times, Vol. 21, No. 40, p. 2, Washington, D. C., 19 July 1972.

20. List of 1820 Billets and 1820 Officers as of 1 January 1972, received from the Office of the Oceanographer of the Navy, January 1972.

21. CNO message 072340Z/120 Jul 1972, Subject: Weekly Newsgram from CHINFO (26-72), July 1972.

22. The Ocean Science Program of the U. S. Navy, Office of Oceanographer of the Navy, Alexandria, Va., April 1970.

23. Behrens, W. W., Rear Admiral, USN, "Keynote Address," 8th U. S. Navy Symposium of Military Oceanography 18-20 May 1971, Proceedings, Vol. I, p. 1-5, U. S. Naval Postgraduate School, Monterey, Ca., May 19[illegible].

24. CNO message 061520Z Jul 1972, NAVOP (Z-114), Subject: Ecology Spot Rep, July 1972.

25. Memorandum for Deputy Chief of Naval Operations (Manpower and Naval Reserve) (OP-01), Subject: Navy Professional Manpower Forecast, Environmental Sciences (Oceanography), 26 January 1972.

26. White, Robert M., Administrator of National Oceanic and Atmospheric Administration, "The Changing National Needs for Meteorologists," 52nd Annual Meeting of the American Meteorological Society, Proceedings, New Orleans, La., 10-13 January 1972.

27. Dagdigian, J. J., Commander, USN, "Oceanography at the Naval Postgraduate School," 8th U. S. Navy Symposium of Military Oceanography, 18-20 May 1971, Proceedings, Vol. I, p. 70-73, Naval Postgraduate School, Monterey, Ca., May 1971.

28. Slattery, F. L., Captain, USN, "Recent and Future Developments at NAVOCEANO," 8th U. S. Navy Symposium of Military Oceanography, 18-20 May 1971, Proceedings, Vol. I, p. 30-36, U. S. Naval Postgraduate School, Monterey, Ca., May 1971.

29. Rindskopf, M. H., Rear Admiral, USN, "Highlights of the Navy Oceanographic Operations Program," 8th U. S. Navy Symposium of Military Oceanography, 18-20 May 1971, Proceedings, Vol. I, p. 13-14, U. S. Naval Postgraduate School, Monterey, Ca., May 1971.

30. Davies, T. D., Rear Admiral, USN, "Highlights of the Navy's Ocean Engineering Program," 8th U. S. Navy Symposium of Military Oceanography, 18-20 May 1971, Proceedings, Vol. I, p. 6-12, U. S. Naval Postgraduate School, Monterey, Ca., May 1971.

31. Buck, Jon R., "A Survey of Motion Studies of Support Ships and Handling Payload Dynamics," 8th U. S. Navy Symposium of Military Oceanography, 18-20 May 1971, Proceedings, Vol. I, p. 171-172, U. S. Naval Postgraduate School, Monterey, Ca., May 1971.

32. "People at NAVOCEANO," NAVOCEANO Bulletin, 7-72, p. 5, Naval Oceanographic Office, Suitland, Md., 31 March 1972.

33. Manual of Navy Officer Classifications, NAVPERS 15839B, Department of the Navy Bureau of Naval Personnel, Washington, D. C., 19 September 1968.

34. Center of Naval Analysis Memorandum for Director of Naval Matters, Subject: Subspecialty Code Review, 16 March 1971.

35. Finerty, M. J., Lieutenant Commander, USN, U. S. Naval Oceanographic Office. Personal correspondence dated 7 July 1972.

36. Kotsch, W. J., Rear Admiral, USN, "Highlights of Recent and Future Developments in Environmental Prediction Services," 8th U. S. Navy Symposium of Military Oceanography, 18-20 May 1971, Proceedings, Vol. I, p. 26-29, U. S. Naval Postgraduate School, Monterey, Ca., May 1971.

37. President Nixon's message to Congress on reorganizing the Government's environmental agencies, 9 July 1970. Reprinted in "Man's Control of the Environment," Congressional Quarterly, p. 88-91, Washington, D. C., August 1970.

38. Woods Hole Notes, Vol. 4, No. 1, p. 1-6, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, April 1972.

39. Oceanographic Ship Operating Schedules, Published semi-annually in June and December by the Office of the Oceanographer of the Navy, Washington, D. C.

40. "What Sea Grant Has Meant at Massachusetts Institute of Technology," New England Marine Resources Information 35, p. 1, New England Marine Resources Information Program, University of Rhode Island, Providence, R. I., April 1972.

41. "Sea Grant in the Nation's Capital," Sea Grant 70's, Vol. 2, No. 7, p. 1, Texas A&M University, College Station, Texas, March 1972.

42. Allied Training Programs for Officers and Civilians, 1969-1970, U. S. Naval Oceanographic Office, Career Development Division, Suitland, Md.

43. Webster's New Collegiate Dictionary, G. & C. Merriam Co., Springfield, Mass., 1953.

44. "A Response to Z-Gram 62," College of Command and Staff Report, Naval War College Review, Newport, R. I., September 1971.

45. Burke, Arleigh A., Admiral, USN (Ret.), "The Art of Command," lecture delivered at the Naval War College, reprinted in Naval War College Review, Newport, R. I., July 1972.

46. "Headquarters, Oceanographer of the Navy," Organization Chart, 1 May 1972.

47. Barney, W. S., Colonel, USAF, "Leadership: A Treatise for AWS Commanders," 15 March 1955.

48. Hahs, Orrie A., Captain, USN, "Soul-Searching at the Naval Postgraduate School on the Objectives of Our Educational Program," Seminar on Output Measurement Education 1970, p. 10-12, Navy Management Systems Center, U. S. Naval Postgraduate School, Monterey, Ca., 1-4 December 1970.

49. Mazzola, V. S., Lieutenant Commander, USN, "Letter to the Editor," The BAROMETER, p. 6, U. S. Naval Postgraduate School, Monterey, Ca., 22 May 1972.

50. "International Policy Issues Pertaining to Oceanography and Environmental Sciences (GV-3901)," Course description, U. S. Naval Postgraduate School, Monterey, Ca., March 1972.

51. DeMers, W. H., II, Captain, USN, "Summary of 17 May Meeting," enclosure to Chairman, Oceanography Department letter dated 25 May 1971, U. S. Naval Postgraduate School, Monterey, Ca., May 1971.

52. "Background for a Joint OC/OR Degree Program," Environmental Sciences Programs Curricular Officer draft letter NC4(58Lr)/amb, 17 July 1972, U. S. Naval Postgraduate School, Monterey, Ca., July 1972.

53. Rice, C. L., Commander, USN, Geophysics Detail Officer, Bureau of Naval Personnel, personal communication, Washington, D. C., June 1972.

54. Superintendent, U. S. Naval Postgraduate School letter NC4(34)nb 68822/1100 dated 27 January 1971, Subject: Dual Master's Program, U. S. Naval Postgraduate School, Monterey, Ca., January 1971.

55. "NPS Responsiveness to Navy Needs," Director of Programs, U. S. Naval Postgraduate School, presentation to the Board of Advisors, Seventh Meeting, 11-12 November 1971, U. S. Naval Postgraduate School, Monterey, Ca., November 1971.

56. Oceanographer of the Navy letter, OCEANAV: lme Serial 1511/N33 to Chief of Naval Personnel, Subject: Continuing Education Program, 15 October 1971.

57. Summary of Superintendent's Conference, 16 August 1972, U. S. Naval Postgraduate School, Monterey, Ca., August 1972.

58. Turner, C. P., A Guide to the Educational Experience in the Armed Services, 1968 Edition, American Council on Education, 1968.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Documentation Center Cameron Station Alexandria, Virginia, 22314	2
2.	Library, Code 0212 Naval Postgraduate School Monterey, Ca., 93940	2
3.	Professor D. F. Leipper, Code 58 Department of Oceanography Naval Postgraduate School Monterey, California 93940	3
4.	LCDR Samuel W. Sigmund, USN Code 20 Naval Recruiting Command Headquarters Washington, D. C. 20370	3
5.	Office of the Oceanographer of the Navy 732 N. Washington Street Alexandria, Virginia 22314	1
6.	Naval Oceanography Office Washington, D. C. 20390	1
7.	Office of Naval Research Code 480 Arlington, Virginia 22217	1
8.	Vice Admiral W. W. Behrens NOAA Department of Commerce Washington, D. C. 20230	1
9.	Professor Robert von Pagenhardt Navy Management Systems Center Naval Postgraduate School Monterey, California 93940	1
10.	Professor J. W. Creighton Department of Operations Research and Administrative Sciences Naval Postgraduate School Monterey, California 93940	1

11. Professor R. S. Andrews 1
Oceanography Department
Naval Postgraduate School
Monterey, California 93940

12. Professor J. A. Galt 1
Oceanography Department
Naval Postgraduate School
Monterey, California 93940

13. LCDR C. K. Roberts, USN 1
Assistant Curricular Officer
Environmental Sciences Programs
Naval Postgraduate School
Monterey, California 93940

14. CDR W. C. Knodle, USN 1
Defense Mapping Agency
Building 56
Naval Observatory
Washington, D. C., 20305

15. LCDR E. T. Young, Jr., USN 1
Box 8674
Naval Postgraduate School
Monterey, California 93940

16. CAPT E. M. Cummings, Jr., USN 1
Code N1
Office of the Oceanographer of the Navy
Alexandria, Virginia 22314

17. CDR S. H. Applegarth, USN 1
Code N33
Office of the Oceanographer of the Navy
Alexandria, Virginia 22314

18. Professor J. R. Borsting 1
Code 55Bg
Naval Postgraduate School
Monterey, California 93940

19. CDR Donald Walsh, USN 1
Office of the Assistant Secretary
of the Navy for R&D
Washington, D. C. 20390

20. Curricular Officer, Management and Computer Science Programs 1
Code 36
Naval Postgraduate School
Monterey, California 93940

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

GINATING ACTIVITY (Corporate author) val Postgraduate School nterey, California 93940	2a. REPORT SECURITY CLASSIFICATION Unclassified
	2b. GROUP

PORT TITLE

nagement and the Oceanography Community: A Consideration in ture Navy Oceanography Planning

SCRIPTIVE NOTES (Type of report and, inclusive dates)

ster's Thesis; September 1972

THOR(S) (First name, middle initial, last name)

Samuel Wilson Sigmund

PORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
eptember 1972	195	58

ONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
ROJECT NO.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

ISTRIBUTION STATEMENT

Approved for public release; distribution unlimited.

UPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Naval Postgraduate School Monterey, California 93940

BSTRACT

This study examines the need for oceanography specialists and subspecialists to possess a degree of managerial expertise and concludes that some type of formalized management education is required. Special management skills are required for optimum performance by oceanography officers in nearly all of the more senior billets - Captain, Commander, and the majority of the Lieutenant Commander billets. The study presents the reasoning which leads to the above conclusion and then answers four basic questions: (1) Which oceanography billets require a higher degree of special management skills? (2) Which particular management skills are required? (3) What facilities and/or methods are available for acquiring these skills? and (4) At what level, or rank, would it be most beneficial to acquire these skills?

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Officer Education						
Oceanography Education						
Management Education						
Navy Oceanographic Programs						
Managerial Expertise						
Oceanography Specialists						
Technical Managers						
Oceanography Community						

Thesis 136731
S4937 Sigmund
c.1 Management and the oceanography community: a consideration in future Navy oceanography planning.